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The huge lists of variable stars published in the IBVS-issues Nos. 4417, 4429, 4431, 4433, 4441, 4444, 4448, 4449, 4450, 4451, 4459, 4472, 4476, 4498 are not repeated here.

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ON THE CYCLICITY OF THE S Dor PHASES IN AG CARINAE[1]

AG Car (HD 94910) is a most enigmatic LBV of the southern hemisphere. Its light curve displays episodes of fading and brightening with strongly variable amplitude. In 1995, the star was in one of its brightest maxima since the double maximum of 1981–82, and is now again on its decline. Figure 1 displays the light curve since 1980. The dots are visual estimates collected by one of us (A.J.), the open circles that are connected by a full line represent Walraven V data (transformed to Johnson V) taken from van Genderen et al. (1988, 1990) and Strömgren y data from the "Long-Term Photometry of Variables" (LTPV) project at ESO (Sterken 1983, 1994, for the data see Manfroid et al. 1991, 1994 and Sterken et al. 1993, 1995).

Van Genderen et al. (1996) discussed all available photometric data covering more than one century, and introduced the concept **S Dor phase** (SD), viz. the phases of brightening with a more or less regular pattern of recurrence. In particular, they introduce a new nomenclature and distinguish "normal S Dor phases" superimposed on a much slower rhythm of brightening and fading for which they coin the term "Very-long term S Dor phase (VLT–SD)". For more details we refer to their paper.

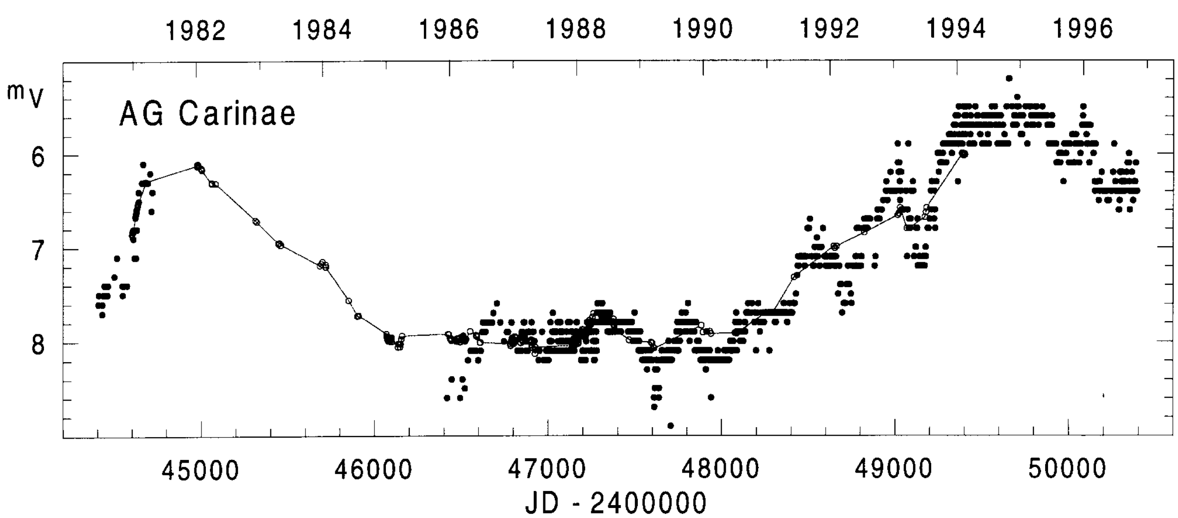

Figure 1. Light curve of AG Car since 1982. • are visual estimates, ∘ are based on data from van Genderen et al. (1988, 1990) and on published LTPV data. The continuous line connects all published. photoelectric V data

[1]Based on observations collected at the European Southern Observatory (Chile)

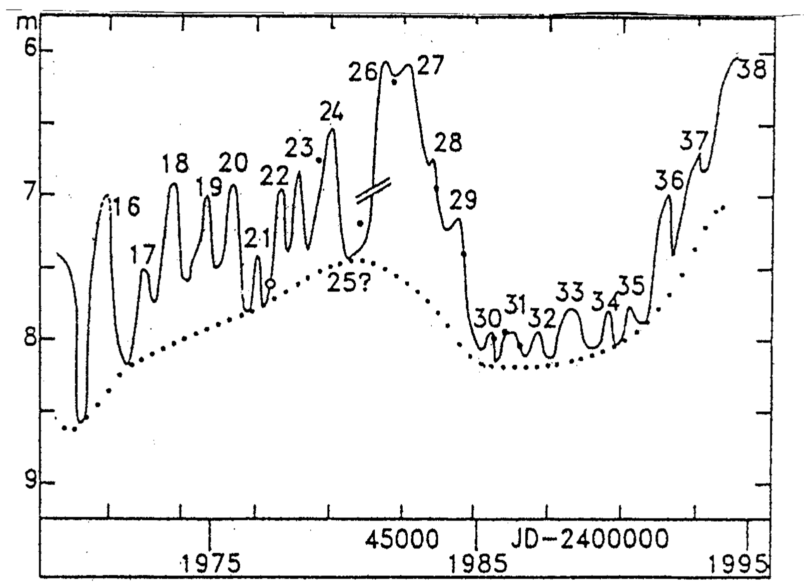

Figure 2. Schematic light curve of AG Car since 1970 (adapted from van Genderen et al. 1996). The solid line covers the observations, the dotted line is the lower envelope of the continuous line and illustrates how the authors think the underlying VLT-SD phase could be represented. The numbered maxima do not correspond to the cycle numbers as shown in Figure 4. Note the double maximum 26–27.

From 1970 on (after JD 2440000), the light curve shows a fairly uninterrupted sequence of S Dor maxima. Numbered 17–38 in the van Genderen et al. (1996) paper, this sequence of 22 times of maximum yielded a period of $373^{\rm d}\pm1^{\rm d}\!.8$ (see Figure 2 for a partial reproduction of Figure 1 of van Genderen et al. 1996). Extrapolating the cycle-numbering scheme to the past, these authors refined the period to $P = 371^{\rm d}\!.4 \pm 0^{\rm d}\!.6$. The resulting $O - C$ diagram did not show a random pattern, but suggested a possible cyclic behaviour on a time scale of about 7900 d or 21.6 y (for the time interval 1970–1994).

Unfortunately, diminishing opportunities for observing AG Car in the framework of LTPV made a complete coverage of the 1994–1995 (double) maximum impossible. However, from a preliminary reduction of yet unreleased LTPV data collected in November and December 1995, we could derive one additional time of maximum, viz. HJD 245 0080, corresponding to cycle $E = 23$ (see Figure 3). The visual light curve also suggests maxima at JD 244 9750, 245 0083 and 245 0350. The photoelectric maximum at $E = 23$ fully confirms the one derived visually. The first of the new visual maxima was not taken to correspond to the brightest estimate, because the real maximum likely occurs around the middle of the corresponding block of data (as is also illustrated by the difference between the brightest y measurement and the maximum of the fitted curve in Figure 4). The maximum at $E = 21$, provisionally estimated at JD 244 9400 and bracketed in Table 1 of van Genderen et al. (1996), in reality seemed to have occurred later—that is, around JD 244 9455. Note that the estimation of the time of extremum during a supermaximum (maxima 26–27 in Figure 2, the double maxima in 1981–82 and in 1994–95) is particularly difficult because the star does not have the time to fall back to its low state of light output before the 371 d cycle is completed.

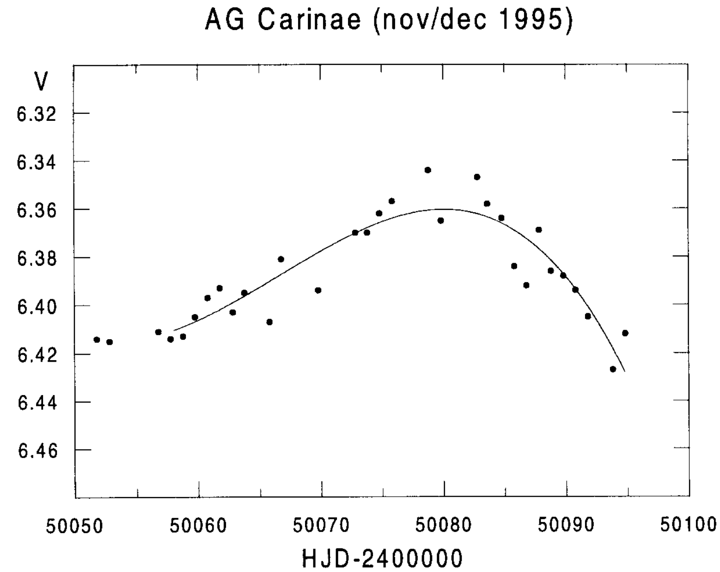

Figure 3. LTPV-1995 $y \equiv V$ photometry (in the natural system). Each data point represents one differential measurement. The line represents the fitted third-degree polynomial used to calculate the time of maximum. Note the asymmetric form, with a descending branch that is much steeper than the ascending branch, a phenomenon that is typical for normal SD phases on the descending branch of the VLT-SD phase, see also Figure 2.

The new $O - C$ diagram is shown in Figure 4. The two estimates of the time of maximum corresponding to $E = 21$ have been flagged by an arrow in Figure 4, as well as the last point in the diagram, which ultimately may turn out to shift upward as suggested in the figure. The figure clearly confirms the cyclic pattern on a time scale of ~ 20 y as suggested by van Genderen et al. (1996).

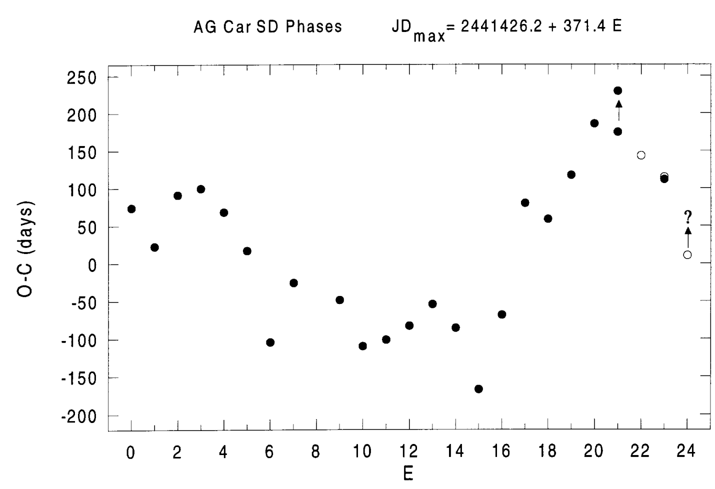

Figure 4. $O - C$ diagram for SD maxima 17–38 (cycle numbers 0–21) of AG Car for the linear ephemeris constructed with $P = 371\overset{\mathrm{d}}{.}4$, van Genderen et al. (1996). The $\bullet$ at $E = 23$ is derived from a sequence of photoelectric measurements, see Figure 3. The open circles at $E = 22 - 24$ are based on new visual estimates. The upper vertical arrow indicates the corrected position of the $E = 21$ maximum (which was provisionally estimated on the basis of incomplete data by van Genderen et al. 1996). The ? indicates the shift to be expected when the current SD phase will have been observed completely.

The new visual and photoelectric data collected after the conclusion of the study of van Genderen et al. (1996) allow us to confirm that the cyclic behaviour of the "normal" S Dor phases of AG Car is maintained.

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THE PERIOD AND LIGHTCURVE OF NSV 4497

The variability of NSV 4497 (= SVS 863 UMa = GSC 2997_1204, $\alpha = 9^{\rm h}29^{\rm m}0\overset{\rm s}{.}59$, $\delta = +43^\circ 44' 2\overset{''}{.}0$, J2000.0) was discovered by Parenago (1938). He classified the star as an eclipsing binary and gave two times when the star was found near minimum light on a photographic plate. The star had been then neglected for a long time, except for an inconclusive visual survey of Locher (1984). We started to observe NSV 4497 in 1992 with an 18-cm telescope and a SBIG ST-4 CCD camera. The observations were continued in 1993–94 with the same telescope but better ST-6 camera. These early observations, made without a filter, confirmed the type of variability and yielded four times of minima and a preliminary period.

In 1996 we performed a regular photometry of NSV 4497 with a 65-cm telescope and the ST-6 camera. Standard V Johnson and R Cousins photometric filters were used. The technical configuration of the telescope, normally used for other purposes, did not allow to change the filters automatically. Instead, in some cases, only one filter was used in a particular night. Typical exposures were as long as 120–180 seconds and the high signal-to-noise ratio enabled the relative precision of one measurement of about 0.010 mag in R and 0.015 mag in V filter to be reached. Altogether 418 measurements in R and 158 in V have been obtained.[1] GSC 2997_1178 was used as the comparison star and GSC 2997_1472 as the check star. The magnitudes were transformed to the absolute scale using the standard stars according to Landolt (1992) and checked by the Guide Star Catalog. Due to the uncertainties in extinction, low precision of photometric data in the GSC and other instrumental effects, the absolute calibration is less certain and a systematic shift as high as 0.1 mag is possible. We derived the magnitude of the comparison and the check star as $V = 12.2, V - R = 0.40$ and $V = 12.3, V - R = 0.49$, respectively. The probable error of the color indices is $0\overset{\rm m}{.}03$. The variable, comparison and check stars are identified in Figure 1.

All times of primary minima are given in Table 1. Using only our minima, we derived the following light elements:

$$\begin{array}{llllll} \mathrm{JD_{hel}\,(min)} & = & 2\,448\,691.3670 & + & 0.7747160 & \times\ \mathrm{E.} \\ & & \pm\ 7 & & \pm\ 4 & \end{array}$$

The $O - C$ residuals relative to these elements are also given in Table 1. Parenago's two minima show negative $O - C$ residuals, probably larger than the error of observation. This suggests that the period of the star was slightly longer in the past but the lack of data prevents to draw a firm conclusion.

[1] The table of observational data (in ASCII format) is available as the 4402-t3.txt file together with the electronic version of the Bulletin.

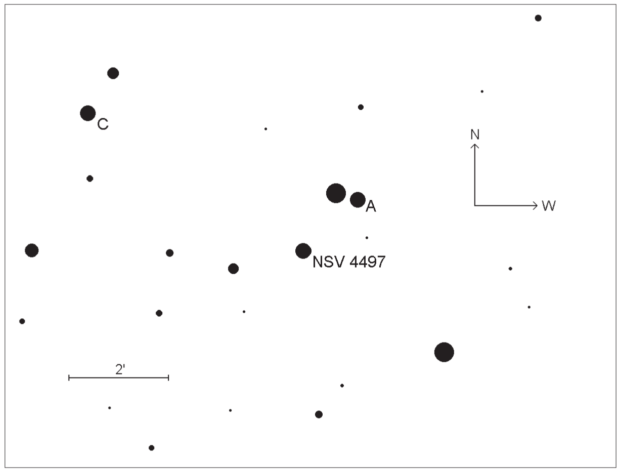

Figure 1. Identifications chart of NSV 4497. The size of the field is $12'.6 \times 9'.6$. The comparison star is denoted with A and the check star is C.

Table 1. The times of minima of NSV 4497

$\mathrm{JD_{hel}} - 2\,400\,000$		f	N	w	E	$O - C$	source
17 321.41		pg	1	0	−40492	−0.16	Parenago (1938)
28 625.38		pg	1	0	−25901	−0.07	”
48 691.367	± 0.002	–	17	1	0	−0.000	18-cm, ST-4
49 028.370	± 0.007	–	9	1	435	+0.002	18-cm, ST-6
49 031.467	± 0.002	–	13	1	439	−0.000	”
49 423.473	± 0.004	–	15	1	945	−0.001	”
50 141.6354	± 0.0002	R	48	5	1872	+0.0000	65-cm, ST-6
50 142.4097	± 0.0004	R	40	5	1873	−0.0004	”
50 152.4807	± 0.0002	V	35	5	1886	−0.0007	”
50 396.5178	± 0.0003	R	27	5	2201	+0.0009	”

f: filter, N: number of measurements, w: weight, E: epoch

Table 2. The lightcurve parameters of NSV 4497

	M_{max}	A_{I}	A_{II}
V-band	11.9	0.50 ± 0.03	0.08 ± 0.03
R-band	11.7	0.48 ± 0.02	0.11 ± 0.02

M: magnitude, A: amplitude [mag]
I, II – primary and secondary minimum, respectively

The mean lightcurve of NSV 4497 in the V and R filters is given in Figure 2. It is a typical lightcurve of an Algol-type eclipsing binary. The eclipses are partial and their duration is $3^{\mathrm{h}}.1$, i.e. 17% of the period. No sign of asymmetry is present. The magnitudes are summarized in Table 2.

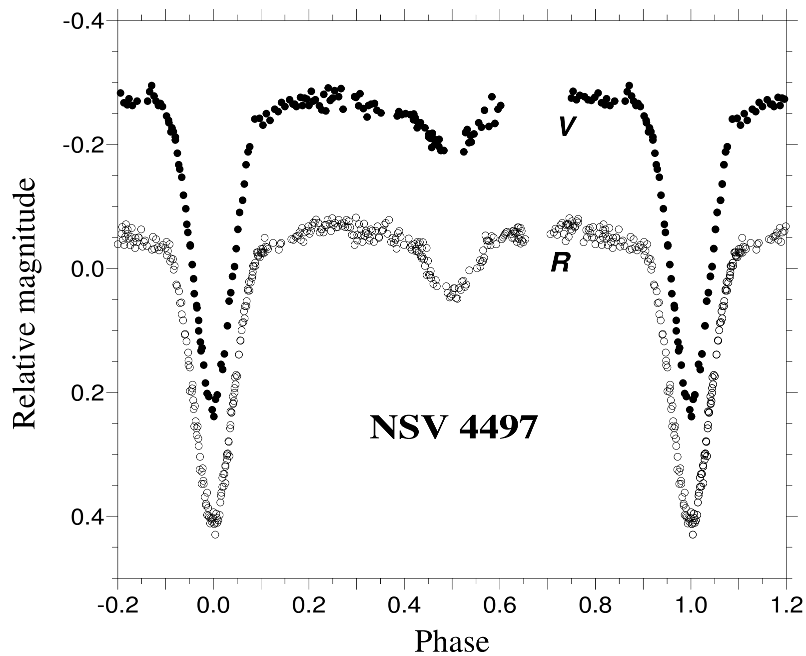

Figure 2. The mean lightcurve of NSV 4497. Relative V, R magnitudes to the comparison star A are given

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A NEW VERY LONG PERIOD VARIABLE STAR IN NORMA

IAU Circular 4075 reported the possible photographic discovery on May 27, 1983 of a nova by W. Liller, and the same IAUC reported that the object's existence had been confirmed by R.H. McNaught and D. Overbeek, and by D. Baade and J. Krautter. The last pair of observers obtained a spectrogram which showed several strong, narrow Balmer lines in emission plus Fe II at 492.3nm, but also "strong molecular bands as in stars of spectral type M3-M5". They go on to say that "the object may be related to the class of symbiotic stars although no trace of emission due to [O III] 495.9 and 500.7-nm and He II 468.6-nm are seen". McNaught noted that the star appeared "clearly red" and further reported that a search of "10 photographic charts back to 1916 shows its variation from mag 13 to fainter than B = $15\overset{m}{.}9$. He also gave a precise position (Equinox 1950):

$$\text{R.A.} = 16^{\text{h}}03^{\text{m}}02\overset{s}{.}92,\ \text{Dec.} = -51^{\circ}56'32\overset{''}{.}6$$

The variable appears in the Hubble Guide Star Catalog; its average position from two GSC determinations is (Equinox 2000):

$$\text{R.A.} = 16^{\text{h}}06^{\text{m}}51\overset{s}{.}67,\ \text{Dec.} = -52^{\circ}04'34\overset{''}{.}7$$

The GSC magnitudes listed are 11.73 and 12.27. Duerbeck (1987) includes the star as "N Nor 1985/2 ... variable of late type" (p. 74-75) and provides a finding chart (p. 179).

His curiosity aroused, A.F. Jones began to make visual observations of the star while Liller continued to take photographs of this region of the Southern Milky Way as a part of his continuing PROBLICOM nova search program. Later, with the acquisition of a CCD, Liller started to follow the brightness changes of the star using a 20-cm f/1.5 Schmidt camera and various filters.

As of this writing eight maxima have been observed, and Figure 1 shows the light curve around the well-observed maximum of 1993 as measured visually by Jones and with an unfiltered CCD by Liller. The more than 2-magnitude difference in the peak magnitudes obviously results from the strong red (and by inference infrared) continuum reported in IAUC 4075 by Baade and Krautter and the extended red and infrared sensitivity of the CCD. Especially noteworthy are (1) the pre-maximum standstill clearly visible in the CCD measurements and just barely detected by Jones; and (2) the much slower decrease in brightness after maximum as measured with the CCD than visually (0.6 mag compared with 2.6 mag during the first 100 days). However, the two times of occurrence of peak brightness agree very closely at JD 2,449,034.

Combining all the observations available, we arrive at a mean period of 558.8 days (1.53 years). Times of maximum for the rest of this century are herewith predicted to be on or about Oct. 20, 1997 and May 1, 1999.

The period of the Norma variable is considerably longer than the 278 days given by Hoffmeister et al. (1985) as the maximum of the period distribution of all Mira variables; indeed, only 13 Miras (of 2,994) are listed as having periods longer than 550 days. However

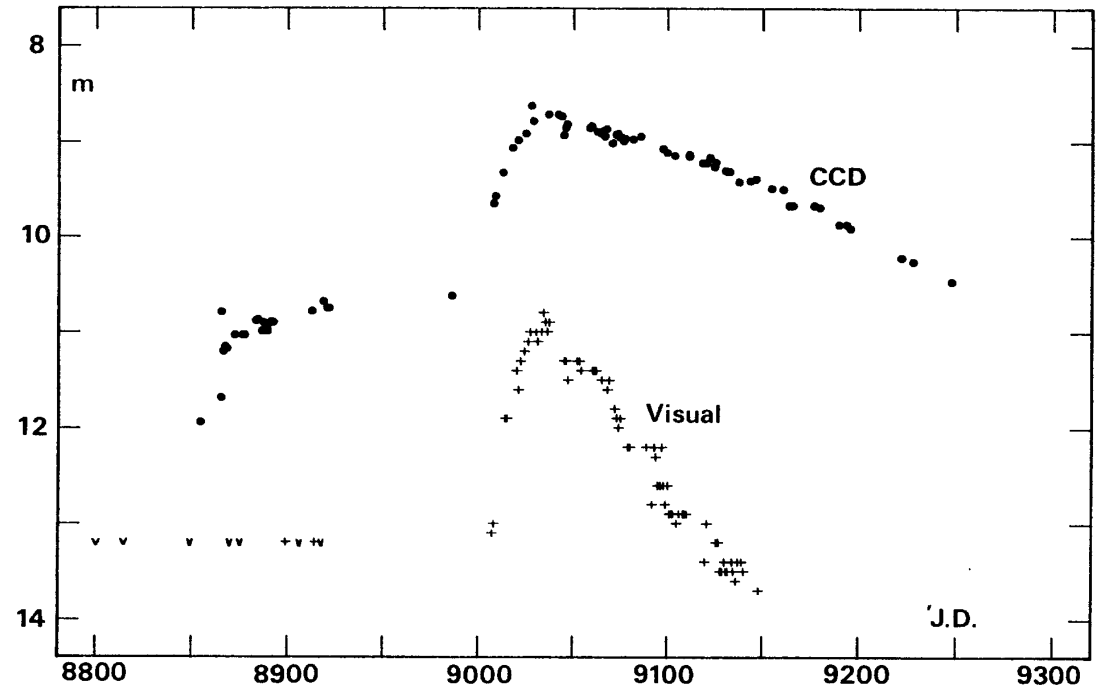

Figure 1. The light curve of the new variable in Norma showing Jones's visual magnitudes (crosses) and Liller's non-filtered CCD magnitudes (closed circles). The v's represent selected "fainter than" estimates. Note the two positive visual sightings near J.D. 2,448,900; both were very close to the limit of detectability on those nights.

the period of the Norma variable is still far less than that of the 1374-day period given for BX Mon and listed as a symbiotic Mira variable (Sp. M4ep + F) in the 4th edition of the General Catalogue of Variable Stars (Kholopov et al., 1985).

We intended to publish elsewhere all the observations which we have accumulated; meanwhile the numerical data can be obtained by writing the first author.

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UNUSUAL FADING OF V1357 CYGNI (Cyg X-1) IN EARLY NOVEMBER, 1996

Monitoring of V1357 Cyg, an optical counterpart of the X-ray source Cyg X-1 and known black hole candidate, was carried out at Tien-Shan astronomical observatory (Kazakhstan) from October 4 to November 14, 1996. The 1-meter reflector and a four channel WBVR photometer were used. The A1V type star HD 189474 ($19^h58^m51\overset{s}{.}6$, $+35°29'52''$; 2000, V = $6\overset{m}{.}998$) was used as a comparison star in this observational set. Its magnitudes were taken from the Catalogue of WBVR Magnitudes of Northern Sky Bright Stars (Kornilov et al. 1991). Two check stars selected by Lyutyi (1972), 'a' ($19^h58^m21\overset{s}{.}7$, $+35°13'54''$; 2000) and 'c' ($19^h58^m06\overset{s}{.}3$, $+35°22'47''$; 2000), were measured regularly with the variable star. The 22" diaphragm was always used for the visual binary 'a', thus we measured the combined brightness. The star 'a' was found to be a small amplitude variable in the range of $10\overset{m}{.}012 - 10\overset{m}{.}035$ V, with one of the two possible periods: $P_1 = 4\overset{d}{.}223 \pm 0.005$ and $P_2 = 1\overset{d}{.}3009 \pm 0.0005$.

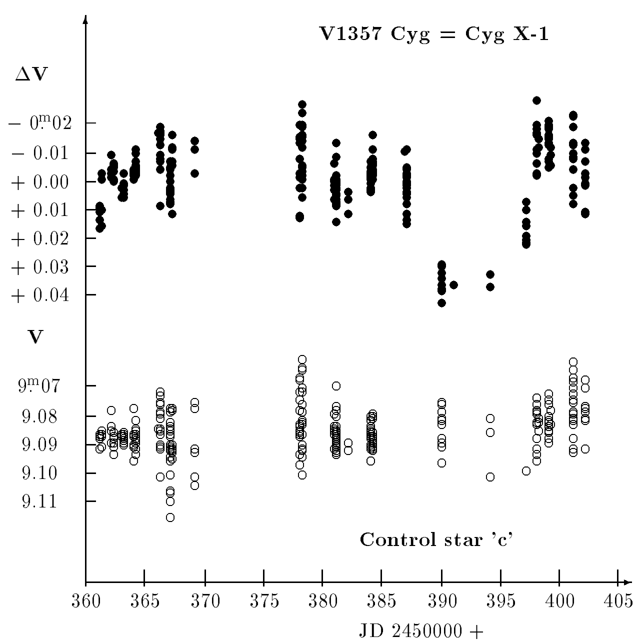

Figure 1. Light curves of V1357 Cyg and of the check star. ΔV are deviations of observations from the mean ellipsoidal light curve.

V1357 Cyg normally shows ellipsoidal double wave variability with the period of P = $5\overset{d}{.}6$ and the total mean amplitude of $0\overset{m}{.}05$ V. The accuracy of an individual measurement was in the range of $0\overset{m}{.}003-0\overset{m}{.}010$. But on November 2 the star was found to be fainter by $0\overset{m}{.}04$ V than the mean ellipsoidal wave level and its brightness became lower by $0\overset{m}{.}02$ than Min I. Deep fading of V1357 Cyg without colour variations was seen on JD 2450390 – 397. During this time the star demonstrated ellipsoidal variations with the former amplitude in all the photometric bands. Figure 1 shows light deviations of V1357 Cyg in V band against the normal double wave level and the light curve of the check star ‘c’. The OB star light predominates in the radiation of this system. The contribution of the accretion disk into combined light was estimated by Bruevich et al. (1978) to be $0\overset{m}{.}04$ V. This value is approximately equal to the depth of the fading. The dramatic change of the brightness level may suggest a strong change of the accretion disk structure which has led to the disappearance of the optical radiation from the disk.

It would be very important to know the behaviour of the X-ray radiation at this time.

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NEW ECLIPSING BINARY STAR CoD $-24°12698$ IN THE DIRECTION OF THE STAR-FORMING REGION ρ Oph

The members of the Upper Scorpius region were observed by Eggen (1983) in an extensive intermediate band and H_β photometry. He detected the variability of CoD $-24°12698$ (SAO 184441). The star was changing its light from $10\overset{m}{.}1$ V (August 24, 1980) to $10\overset{m}{.}3$ V (September 23, 1981). In September 1980 the star had a brightness of $9\overset{m}{.}4$ R and $0\overset{m}{.}594$ R$-$I while the respective values were and $9\overset{m}{.}7$ and $0\overset{m}{.}607$ in July 1981. Herbig (see Struve and Straka, 1962) determined the spectral type to be A0 or A1, but found no emission in 1949. The star is situated in the direction of the star-forming region ρ Oph, near the weak-line T Tauri stars Rox 42 and Rox 43.

We present the results taken from a long-term photometric monitoring program for CoD $-24°12698$ made during three runs from August 5, 1993 to July 23, 1996. Our UBVR observations were obtained at the Mt. Maidanak Observatory, Uzbekistan, using 0.48m and 0.60m telescopes equipped with a pulse counting FEU-79 photomultiplier tubes. The mean error of a observation is typically $\pm\ 0\overset{m}{.}01$ in V. CoD$-24°12690$ was used as comparison star ($7\overset{m}{.}538$ V, $0\overset{m}{.}012$ U$-$B, $0\overset{m}{.}382$ B$-$V and $0\overset{m}{.}236$ V$-$R).

A periodogram analysis of observations proved that CoD $-24°12698$ is a short period eclipsing binary star likely of W UMa type. The ephemeris for the primary minimum is

$$\begin{array}{lclcl} \text{Min.I} = \text{JDH } 2449204.349 & + & 0\overset{d}{.}589352 & \times & E \\ \qquad\qquad\qquad\qquad\pm 1 & & \pm 1 & & \end{array}$$

The total number of observations are 151 in U, 203 in B, 210 in V and 197 in R. We detected 11 moments of minima and they are listed in Table 1. The light curves of the binary are shown in Figure 1. The main photometric characteristics are given in Table 2.

Table 1

JDH2400000+	E	O$-$C	JDH2400000+	E	O$-$C
49213.1855	15	$-0\overset{d}{.}004$	50243.3686	1763	$-0\overset{d}{.}008$
49226.1520	37	-0.003	50243.3788	1763	$+0.002$
49520.2530	536	$+0.011$	50249.2761	1773	$+0.006$
49540.2772	570	-0.002	50275.1964	1817	-0.005
49540.2821	570	$+0.002$	50275.2101	1817	$+0.008$
49543.2351	575	$+0.009$			

Table 2

Phase	V	U−B	B−V	V−R
Max	10.01	0.40	0.95	1.03
MinI	10.38	0.49	1.00	0.96
MinII	10.11	0.40	0.95	1.03

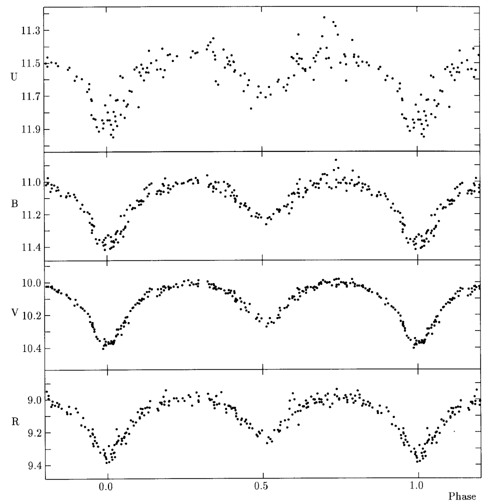

Figure 1. Light curves in the U,B,V and R bands for CoD $-24°12698$.

The change in the colors of the variable is slight. We note that the position of the binary in the color-color diagram does not correspond to a spectrum A0. The components of the binary may be F-G stars. Perhaps, the binary is a foreground object in the direction of the star-forming region ρ Oph.

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GSC 4261.1197: A NEW ECLIPSING BINARY

[BAV Mitteilungen Nr. 94]

In a photometric investigation in the field of PX Cep, one of the stars, GSC 4261.1197, proved to be variable. A check of the GCVS and NSV catalogs did not reveal any previously known variable at this position. The Guide Star Catalog quotes GSC 4261.1197 as a non–stellar object, possibly caused by a nearby $15^{\rm m}$ star, merging with the new variable. The brightness of GSC 4261.1197 is given as $13\overset{\rm m}{.}96$.

Observations were performed in 14 nights between June and November 1996. An ST6 CCD–camera without filters attached to a 20cm SC–telescope was used. The primary and secondary minima have an amplitude of $0\overset{\rm m}{.}45$ and $0\overset{\rm m}{.}38$ respectively. As the variable always was measured together with its companion in the differential aperture photometry, the real amplitude of both minima may be somewhat greater. GSC 4261.1333 served as comparison star; several other stars in the same field were used to check its constancy. The time between first and last contact is about 4.5 hours; a total eclipse could not be detected. The individual measurements are sent via e-mail on request. Obviously the brightness in maximum light is not constant. This may result from interference with the nearby companion. If not, GSC 4261.1197 may be of RS CVn–type.

A period analysis program based on the algorithm of Schwarzenberg–Czerny (1989) together with the times of minimum light resulted in the preliminary ephemeris:

$$\begin{array}{l} \text{Min I} = \text{HJD}\,2450249.4783 + 2\overset{\rm d}{.}553689 \times \text{E} \\ \qquad\qquad\qquad\qquad\quad \pm 4 \qquad\qquad\quad \pm 8 \end{array} \qquad (1)$$

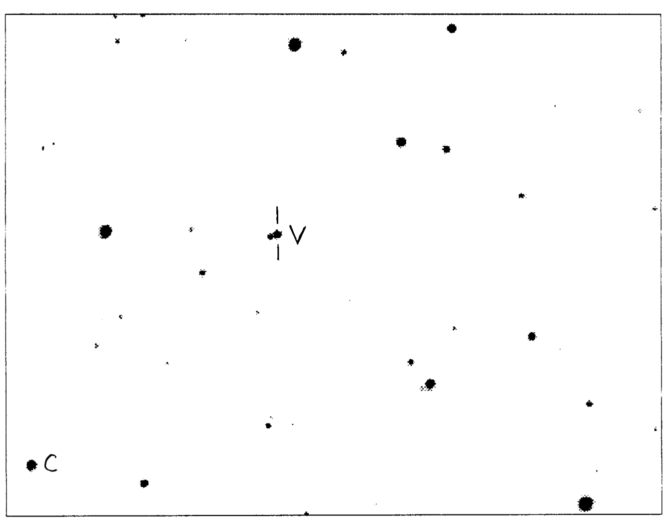

Figure 1. Finding chart for GSC 4261.1197 (v); the comparison star is c. North is up, east to the left. The field is 8$\overset{\prime}{.}$6 × 6$\overset{\prime}{.}$5.

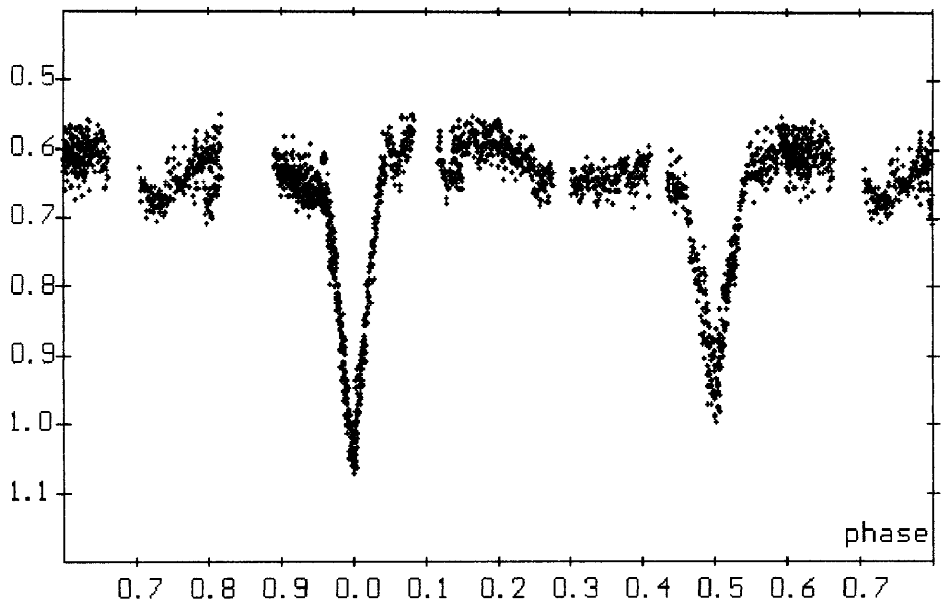

Figure 2. Differential light curve of GSC 4261.1197, drawn with the ephemeris derived in this paper.

Table 1. Times of CCD–measured minima for GSC 4261.1197, epochs and residuals computed with respect to the ephemeris derived in this paper.

N	JD hel	W	Epoch	O–C
1	2450249.4765	2	0.0	−0.0018
2	50304.3891	1	21.5	+0.0065
3	50360.5625	2	43.5	−0.0013
4	50369.5022	2	47.0	+0.0005
5	50392.4843	2	56.0	−0.0006

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NSV 08513, A NEW DETACHED ECLIPSING BINARY STAR IN OPHIUCHUS

According to Kholopov (1982), the variability of NSV 08513 (BD −00°3264, BV 0167, CSV 007634, GSC 5066.0280) was announced by Strohmeier et al. (1957), who indicated that this object underwent fast light changes between photographic magnitudes $10^{m}_{.}7$ and $11^{m}_{.}4$, without specifying the type of variability. In the Guide Star Catalogue, NSV 08513 is a star with a photographic magnitude of 10.75 ± 0.28. This magnitude value was determined from photographic plates taken with the U.K. SERC Schmidt Telescope using a GG 395 filter and a IIIaJ photographic emulsion. The spectral information recorded in the NSV catalogue indicates that the spectral type of NSV 08513 is A1.

To confirm its variability, NSV 08513 was observed in the V band for 24 nights, from 14 June to 13 September 1996, using a CCD camera attached to a 0.2-m telescope from Zaragoza and Morata de Jalon (Spain). GSC 5066.0580 and GSC 5066.0188 were used as comparison and check stars respectively. Photometric reductions suggest that the check star might be slightly variable. It is planned to monitor this object in the near future to check its variability.

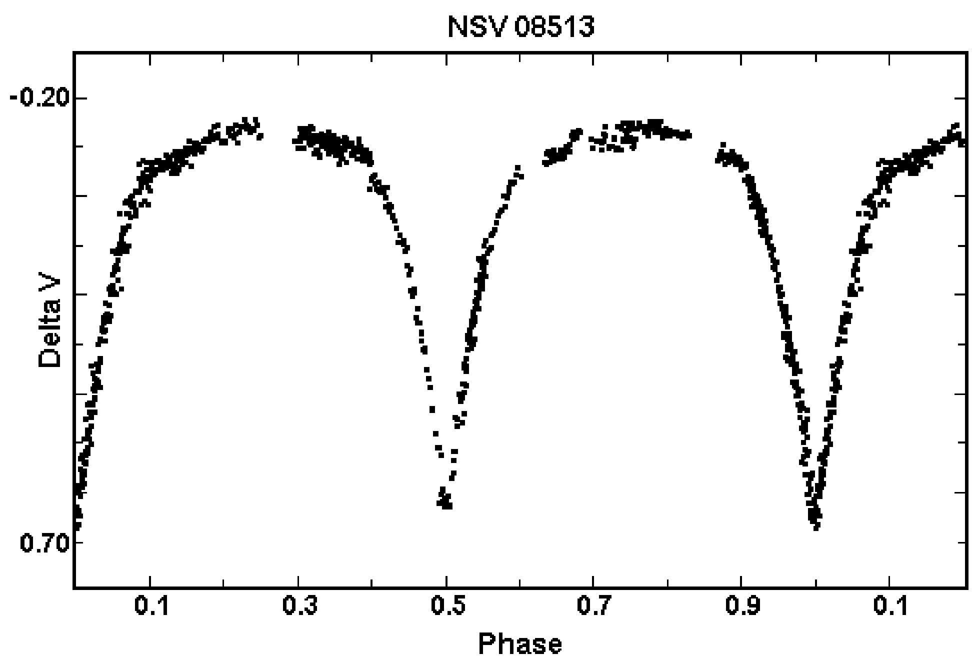

Figure 1

Observations show that NSV 08513 is a detached eclipsing binary star with a period close to 1.8 days (see Figure 1). The depth of the primary minimum in the V band is $0^{\rm m}\!\!.77 \pm 0^{\rm m}\!\!.02$. The secondary minimum is about 0.02 magnitudes shallower (Figure 1). The following ephemeris has been computed:

$$\begin{array}{ll} \text{Min. I} = \text{HJD}\, 2450265.4518 + 1^{\rm d}\!\!.7631 \times \text{E} \\ \qquad\qquad\qquad\qquad\quad \pm 0.0010 \pm 0.0005 \end{array}$$

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RY TAURI AT HIGH BRIGHTNESS

The T Tau star RY Tau has increased its brightness from V=$10\overset{m}{.}6$ to V=$9\overset{m}{.}6$ in the period from middle of October to middle of November this year, with no changes in U−B and B−V. Photometric monitoring of RY Tau is going on at the Crimean Laboratory of the Sternberg Astronomical Institute, Russia, with the 60-cm telescope and the photon-counting photometer. The following is a subset of the photometric data from 1995 and the recent observations in October and November 1996 (also plotted in Figure 1):

JD 2450...	V	U−B	B−V
060.3042	10.57	+0.56	+1.09
064.4076	10.46	0.56	1.08
...	...	...	...
362.5437	10.60	0.38	0.96
373.5500	10.22	0.51	1.04
392.5924	10.01	0.59	1.09
400.4896	9.85	0.58	1.05
402.5382	9.60	0.46	1.01
408.4861	9.72	0.60	1.07

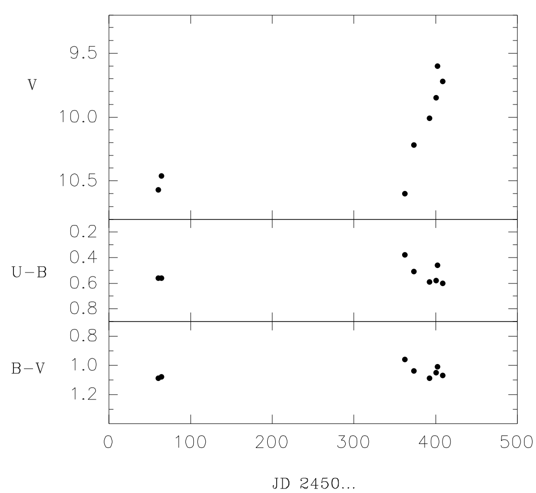

Figure 1. Light and colour variations of RY Tau

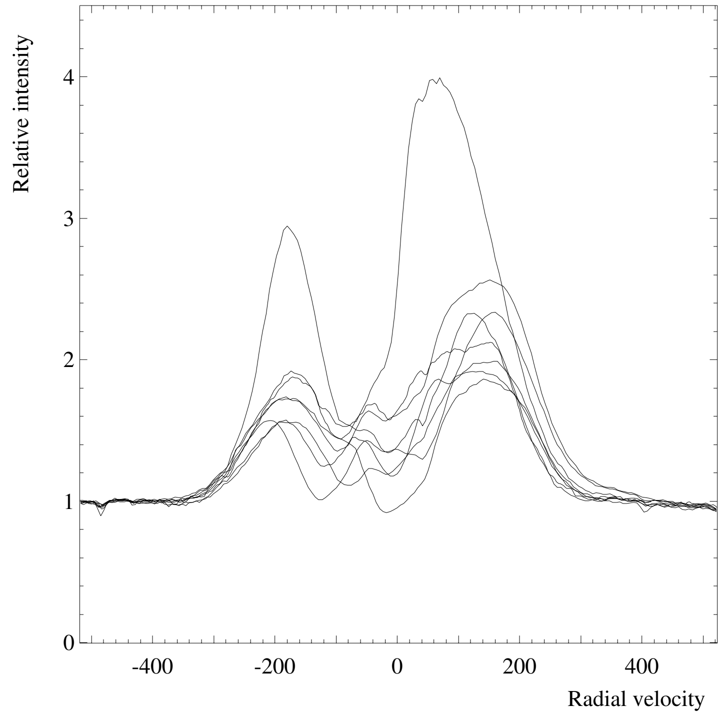

Figure 2. Variations in Hα profile: the most intensive profile is of December 1995 (low brightness of the star), others are of November 1996 (high brightness)

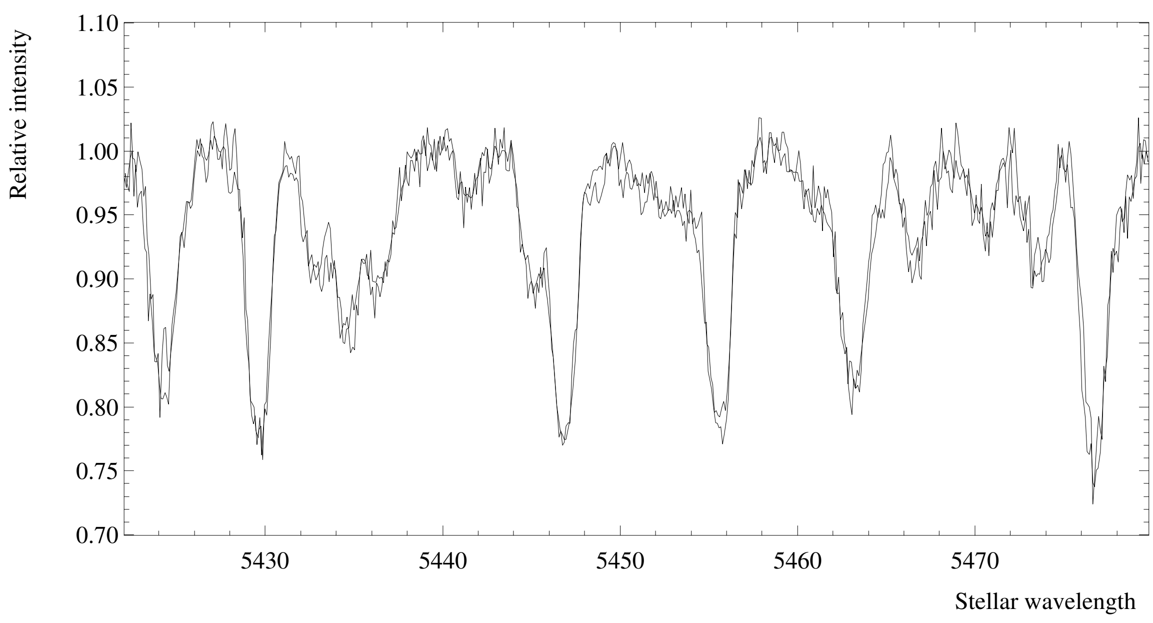

Figure 3. Fragment of the photospheric absorption spectrum of RY Tau, taken at different brightness of the star (the spectra are overplotted). No difference in line profile or intensity is noticeable

High-resolution echelle spectra of RY Tau were taken with the SOFIN spectrograph at the 2.5-m Nordic Optical Telescope (La Palma, Spain), at low brightness of the star (5 Dec. 1995) and at high brightness (20 Nov., 22 Nov., 25 Nov., 27-30 Nov. and 1 Dec. 96). The spectral range was 400-900 nm, the resolving power 25000, S/N ratio 170. In spite of the large brightness difference, all the spectra show the same photospheric spectrum of a late G star, with the same line depths and line ratios, and with the same veiling factor of about 0.5. The equivalent width of Hα emission has changed from 1.8 nm to 0.7 nm, that is the flux radiated in the line remains at about the same level as before the brightening of the star (see Figure 2). The spectra taken at high brightness of RY Tau show the usual night-to-night variations in emission line profiles of HI and CaII: superposition of broad emission with multiple variable absorption components at radial velocities from $+50$ to -150 km/s. No variations were found in photospheric absorption lines (see Figure 3).

Similar event of brightening of RY Tau by more than one magnitude with constant colours was observed in 1983/84 (Zajtseva et al., Sov. Astron.Lett., 11(2), 109, 1985).

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HV 2554 AND THE SUPERSOFT X-RAY SOURCE RX J0527.8–6954[1]

The discovery of the supersoft X-ray source RX J0527.8–6954 during the *ROSAT* first light observation (Trümper et al., 1991) of the Large Magellanic Cloud (LMC) in June 1990 has directed some attention to the optical variable HV 2554 because its location is within the X-ray error circle of RX J0527.8–6954 (Trümper et al., 1991, Greiner et al., 1991). Later ROSAT observations improved the X-ray position resulting in a larger offset to HV 2554 (Cowley et al., 1993, Greiner et al., 1996a,b). However, it also became clear that there are no exact coordinates available (no SIMBAD entry) for HV 2554. To our knowledge the only finding chart available for HV 2554 is the Large Magellanic Cloud atlas by Hodge & Wright (1967) (see Figure 1), but unfortunately the scale is too poor and the variable itself invisible. While only a summary of the variability of HV 2554 is published in form of table entries in Shapley & Mohr (1940) (based on the investigation of only 12 plates) and Shapley & McKibben Nail (1955), the detailed notes of the Gaposchkins (C.H. Payne-Gaposchkin and S. Gaposchkin) on the brightness estimates of HV 2554 on 380 plates (taken between 1896 and 1954) of mainly the A series are unpublished.

Given these facts we went back to the original plates and re-identified HV 2554. From the unpublished individual brightness estimates (recently archived by D.L. Welch and electronically available on http://www.physics.mcmaster.ca/HCO/) we selected four plates: two with HV 2554 being brightest and two plates with it being in a faint state. A comparison of the brightest/faintest plate pairs quickly revealed a clearly variable object with an amplitude consistent with the value of Δm$\sim$1.6 mag (Shapley & McKibben Nail, 1955). Our independent relative brightness estimates on nearly 30 further plates are in good agreement to those of the Gaposchkins and thus confirm the correctness of our re-identification. The astrometry on plates showing HV 2554 in the bright state is overplotted on a CCD frame taken in March 1995 (small circle in Figure 2) and demonstrates that its position is within the 5$''$ X-ray error circle of RX J0527.8–6954.

These findings provided the motivation to determine the pattern of optical variability of HV 2554 over the last six years during which RX J0527.8–6954 was found to gradually decline in X-ray intensity (Greiner et al., 1996a,b). For this purpose, we investigated about 140 blue plates out of the 447 plates (210 blue, 230 red) taken between Oct. 1990 and Jan. 1995 within the EROS project for the search of microlensing events of the LMC (Aubourg et al., 1993). Two different emulsions were used in the blue passband (with filter GG385): IIaO during 1990–1993, and the emulsion IIIaF during Oct. 1993–1995. While plates of both emulsion types are generally more sensitive than the Harvard plates, the IIIaF emulsion even provides a spatial resolution below 2$''$, thus reaching in best cases a quality comparable to the CCD image shown in Figure 2 (seeing of 0$\farcs$9). As a consequence, in most cases several or even all of the at least 6 objects within the astrometric error circle of HV 2554 are resolved and detectable on these EROS project

[1]PARTLY BASED ON OBSERVATIONS WITH THE ESO 2.2 M TELESCOPE AT LA SILLA/CHILE (MPI TIME).

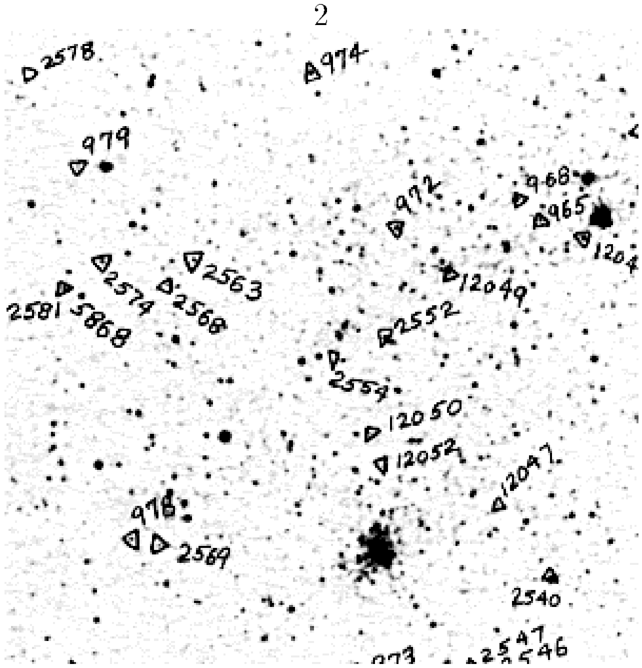

Figure 1. A 13.′5 × 13.′5 area around HV 2554 (center) reproduced from the Hodge & Wright (1967) atlas of the LMC. The variable is located inside the triangle above the "2554" mark. North is at the top and East to the left.

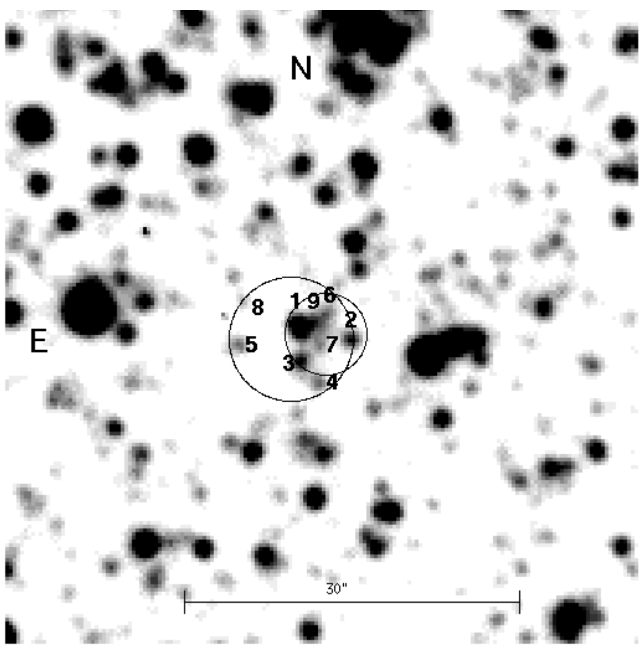

Figure 2. The 5″ X-ray error radius (large circle) of RX J0527.8–6954 overplotted on a 10 min B image taken on March 25, 1995 with the ESO 2.2 m telescope at La Silla/Chile. The small circle denotes the best-fit astrometric position of HV 2554 as determined from plate A 14531 of the Harvard plate collection. Numbers denote all resolved objects within the X-ray error circle (large circle, Greiner et al., 1996a).

plates. In addition to these plates, we have investigated single plates taken for other purposes in 1975, 1977, 1978, 1987 and 1989. The surprising result of our analysis of all the investigated plates was the fact that we did not find any variable object within or around the astrometric position of HV 2554.

The non-variability of any of these objects on the EROS Schmidt plates as opposed to the apparent variability on the Harvard plates can be due to several reasons:

1. *The re-identification of HV 2554 is wrong* while the original measurements are of a different object. We have carefully checked this possibility, but can definitely exclude it. There is no other star of the given brightness around the position marked on the Hodge & Wright (1967) atlas, and in addition the variability pattern found on the plates coincides with that of the unpublished notes of the Gaposchkins.
2. *HV 2554 has ceased to be variable* in the two decades between the last Harvard plates (1954) and the first EROS project plates (1990) (with the few other, individual plates it would be even before 1977). Though this would be a rare circumstance, it cannot be excluded.
3. *HV 2554 is not intrinsically variable on the Harvard plates.* Instead, the combination of variable seeing and different limiting magnitudes of the plates result in a different size of the image of the several overlapping objects and thus counterfeits a variability. This reasoning implies a clear prediction, namely that HV 2554 appears bright on plates with better than average seeing and sensitivity, so that objects 2, 3 and 6 (and probably also 4) contribute to the size of the merged image while on plates with bad seeing and sensitivity only object 1 is imaged, thus resulting in a considerably smaller size on the plate. A re-investigation of the Harvard plates has indeed confirmed this relation between the brightness of HV 2554 and the plate quality.

We therefore conclude that though variations are seen at first glance on the Harvard plates, a careful look including a consideration of the effects of different seeing, different fog level and limiting magnitude shows that variations of HV 2554 are marginal at best. A hint of support comes from the fact that the measurements on the unpublished notes from the Gaposchkins were crossed out which usually means that they did not consider the object to be variable in the end. We would like to mention, however, that it is not possible to exclude definitely intrinsic optical variability of HV 2554.

Given the large amplitude of the X-ray decline of RX J0527.8–6954 over the last six years (a factor of 50), one is inclined to expect a correlated (either positive or negative) variability of its optical emission. The lack of any obvious optical variability of objects 1 through 9 in Figure 2 (though somewhat uncertain for the faint objects 6 through 9) suggests that none of these is the optical counterpart of RX J0527.8–6954. Sensitive optical observations (imaging and spectroscopy) at sub-arcsecond resolution are certainly required to identify RX J0527.8–6954.

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NSV 03438, A NEW DETACHED ECLIPSING BINARY STAR IN CANIS MINOR

Following the cooperation program between the Esteve Duran Observatory Foundation and the Grup d'Estudis Astronomics, for the identification and study of poorly observed variable stars, NSV 03438 (= WR 032 = CSV 006558) was monitored in the V band for 23 nights using a CCD camera, from 19 January to 5 May 1996. Observations were carried out with the 0.6-m Cassegrain telescope at Esteve Duran Observatory in Seva (Spain) and the 0.4-m telescope at Mollet del Valles Observatory (Spain). GSC 0762.2164 and GSC 0762.2280 were used as comparison and check stars respectively. NSV 03438 could be unambiguously identified with GSC 0762.2022.

In the NSV catalogue (Kholopov, 1982), it is recorded that variability of NSV 03438 was first observed by Weber (1957), who reported that this star was a possible Cepheid with a photographic brightness variation from $10^{\mathrm{m}}_{\cdot}8$ to $11^{\mathrm{m}}_{\cdot}7$.

Our observations show that NSV 03438 is not a Cepheid but a detached eclipsing binary star, with a period over 1.5 days. Phase curve indicates that primary and secondary minima are $0^{\mathrm{m}}_{\cdot}79$ and $0^{\mathrm{m}}_{\cdot}74$ deep partial occultations respectively (Figure 1). The following ephemeris has been derived:

$$\begin{array}{rl} \text{Min. I} = \text{HJD}\, 2450122.48519 & +\ 1^{\mathrm{d}}_{\cdot}535114 \times E \\ \pm 0.00029 & \pm\ 0.000003 \end{array}$$

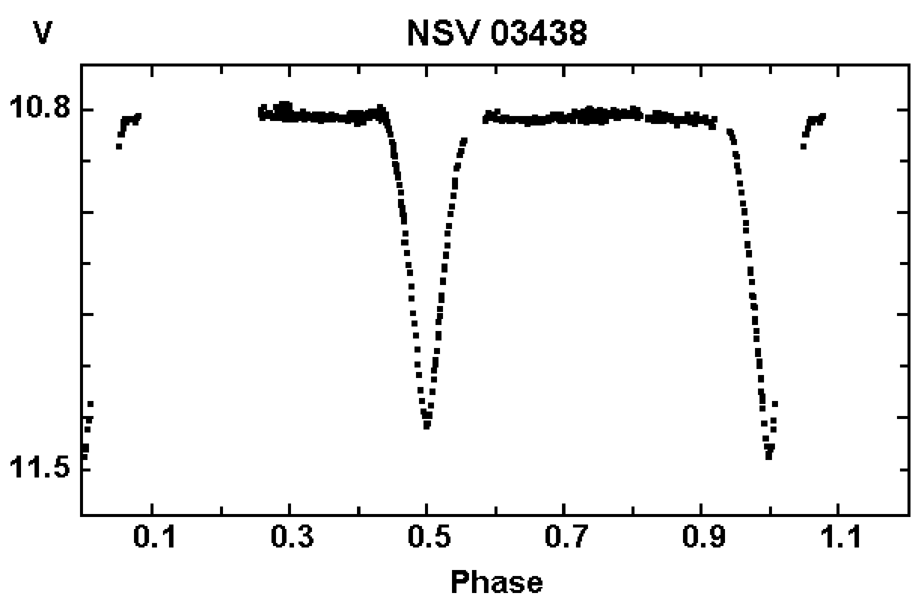

Figure 1

To determine the magnitude and B−V color index of NSV 03438 and its comparison star, these objects were also observed in the B and V bands using an Optec SSP-5A photoelectric photometer. HR 2647, HR 2710, and HR 2760 were used as comparison stars. As a result, it was obtained that NSV 03438 has a visual magnitude at maximum light of 10.81 $\pm$0.05 and an observed color index of 0.49 $\pm$0.11.

Spectroscopic observations and multicolor photometry should be performed in order to obtain more accurate information about this new eclipsing binary star.

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NEW VARIABLES IN THE NORTH-EASTERN PART OF M31

The north-eastern part of M31 has been poorly studied for variable stars in contrast to the south-western one. After the pioneering survey of Hubble (1929) which covered the entire body of the galaxy only 4 fields (each with a diameter of 16′) located at the different galactocentric distances along south-western major axis were studied for variable stars in details (Baade & Swope, 1963, 1965; Gaposchkin, 1962). Only one new 75-day cepheid has been added (Ivanov, 1985) in the north-eastern part since Hubble's times.

The main goal of this work is to look for new variables in the north-eastern part of M31. We used 15 plates (B passband, $40' \times 40'$ field) obtained at the 1 m telescope (f/13) of SAO RAN, Russia from 1990 until 1992. They are centered on $\alpha(1950) = 0^h41^m10^s$ and $\delta(1950) = 41°17'$. This position was considered to include the larger part of the bulge of M31 which is the most probable area for discovering of novae and study of all four Hubble-Sandage variables in Andromeda nebula. The exposure time was usually 4 hours.

A separate calibration curve was constructed for each of our plates. We used 45 standard stars from the photoelectric sequences of Humphreys et al. (1987) and CCD measurements of Massey et al. (1986). The mean error of our calibration curves is about $0\overset{m}{.}1$. The stars were measured with a constant slit photometer.

We selected 19 new variable stars candidates within the investigated area blinking 5 pairs. They were included in a list of 33 known or suspected variables together with previously known 14 variables within the same area. Their coordinates accurate to $\pm\ 0\overset{''}{.}5$ are given in Table 1. The identification chart for these variables is given in Figure 1.

Table 1. Coordinates of known and suspected variables in the NE part of M31

No.	$\alpha(1950)$	$\delta(1950)$	Points	Rem	No.	$\alpha(1950)$	$\delta(1950)$	Points	Rem
	h m s	° ′ ″				h m s	° ′ ″		
1	0 39 31.50	41 03 09.4	13		18	0 41 20.99	41 08 57.9	8	V 13
2	0 39 31.68	41 03 05.9	13		19	0 42 12.45	41 12 03.6	13	
3	0 39 41.01	41 03 17.4	12	V 4	20	0 42 14.54	41 07 17.5	13	
4	0 40 05.31	41 04 19.8	11		21	0 42 13.24	41 07 15.3	12	nova?
5	0 39 28.11	41 09 10.3	12		22	0 41 44.76	41 06 32.6	13	
6	0 39 47.81	41 12 42.2	13	I 1	23	0 41 34.93	41 06 18.3	12	V 15
7	0 40 24.16	41 12 45.7	8		24	0 41 20.03	41 01 50.8	12	
8	0 40 40.46	41 15 10.1	13		25	0 41 15.62	41 01 32.8	12	
9	0 40 36.39	41 20 08.4	7		26	0 41 15.63	41 02 35.9	8	V 6
10	0 40 58.90	41 27 36.7	10		27	0 41 02.69	41 03 09.2	9	V 14
11	0 41 26.65	41 20 31.1	13		28	0 41 00.65	41 00 40.8	11	V 11
12	0 41 06.64	41 18 59.9	4	V 9	29	0 41 32.15	40 57 02.5	9	
13	0 41 17.74	41 13 48.8	10	V 12	30	0 40 48.88	40 55 42.2	9	V 19
14	0 41 07.50	41 11 16.1	11	V 7	31	0 41 04.47	40 53 01.0	3	V 2
15	0 40 51.91	41 07 12.1	12		32	0 40 04.08	41 05 35.0	4	V 8
16	0 40 51.75	41 07 03.6	8		33	0 42 05.88	41 14 09.3	12	VA 1
17	0 41 14.11	41 08 34.9	12						

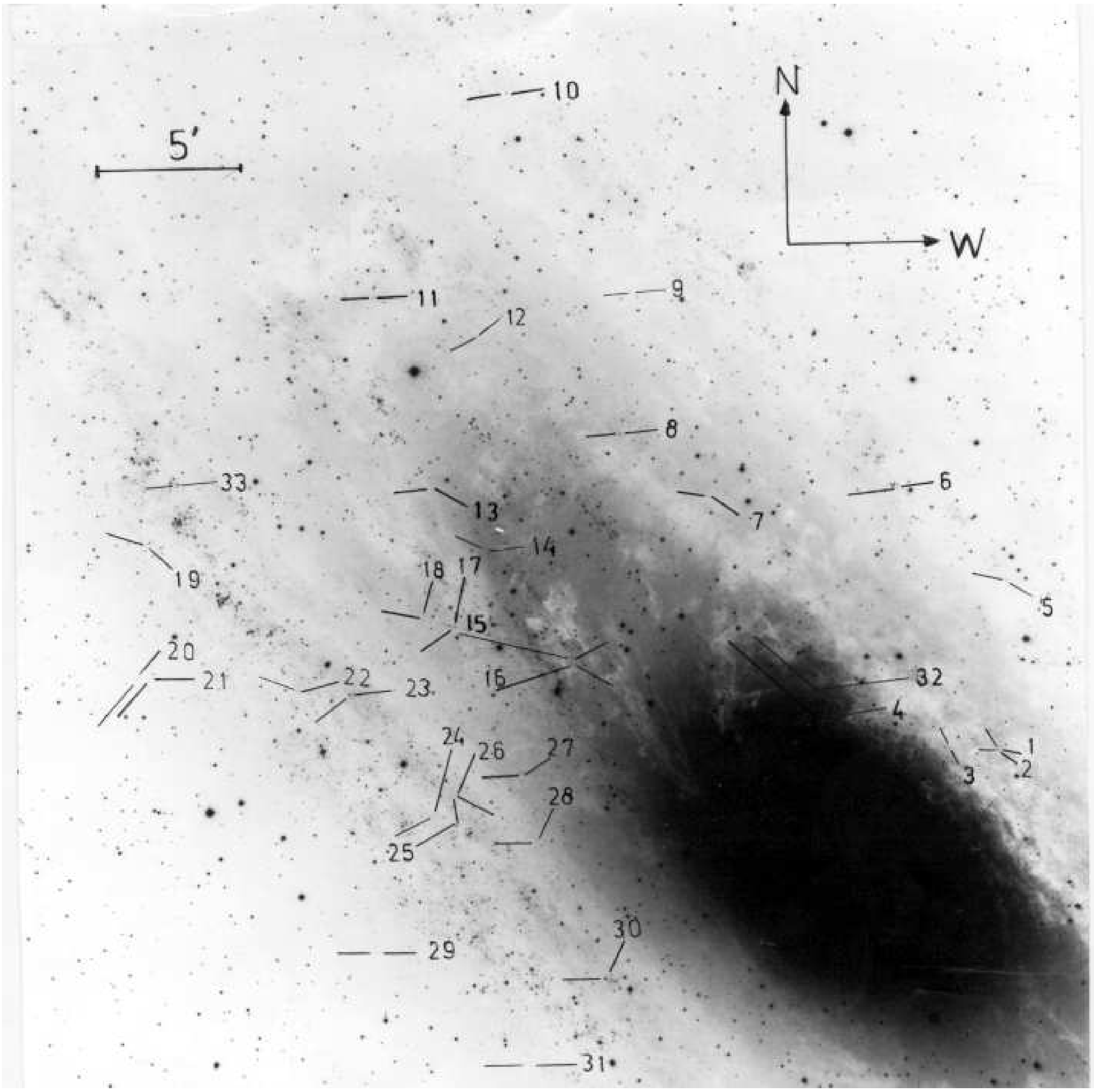

Figure 1

Table 2. Photometry of stars No. 2, No. 5 and No. 28

JD 2 440 000+	No. 2	No. 5	No. 28
8156.5260	19.73	19.10	20.39
8531.4896	19.63	19.28	20.99
8536.4618	19.44	—	20.68
8537.4375	19.67	19.51	20.80
8539.4375	19.49	19.17	20.95
8542.4583	19.78	19.27	21.32
8572.3542	20.15	19.12	—
8649.3767	19.52	19.17	21.21
8650.3577	19.99	19.42	—
8831.6177	19.89	19.21	20.82
8832.5823	19.84	19.11	20.92
8837.6250	20.32	18.61	20.67
8839.6215	20.02	18.85	20.43

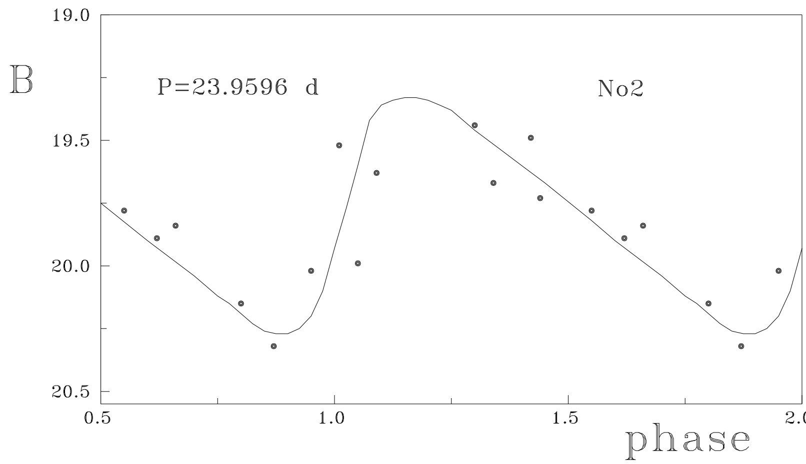

Figure 2. Light curve of star No. 2

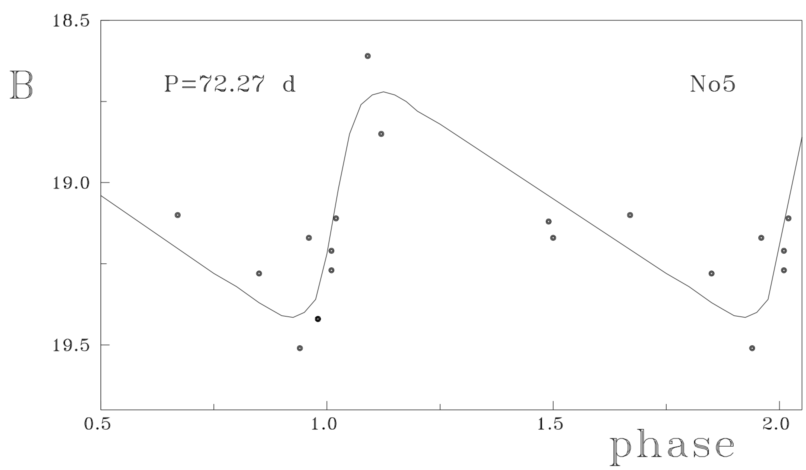

Figure 3. Light curve of star No. 5

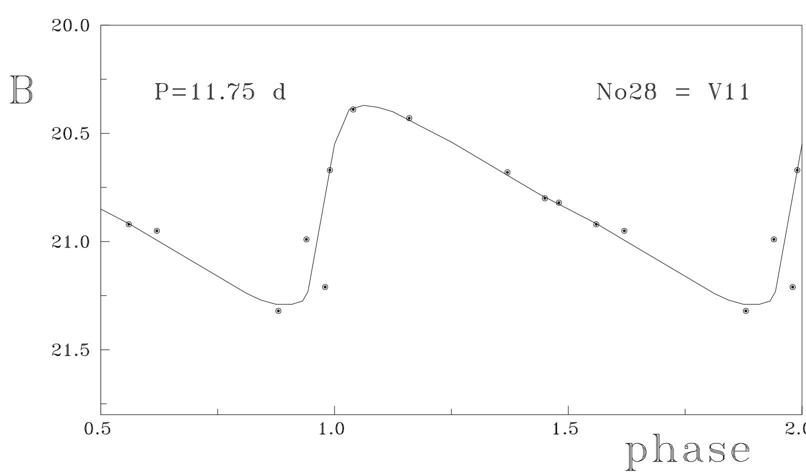

Figure 4. Light curve of star No. 28

Our measurements show that practically all the suspected variables show measurable change in brightness (amplitudes greater than $0\overset{m}{.}7$) but only for 14 of them we can present a list with more than 11 points of observation. A period-finding programme was applied to obtain the appropriate periods. For three of these stars acceptable light curves were found. Photometry of these stars is presented in Table 2.

Figures 2-4 show computed light curves with obtained periods. Luminosities of these variables coincide with the values predicted by the period-luminosity relation for the cepheids in M 31. The star No. 28 was classified from Hubble (1929) as an irregular variable.

The limiting magnitude of our plates prevents us from reaching the levels more populated by cepheids. Most of the known and suspected variables are found out of the boundaries of the OB associations.

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NEW VARIABLES IN THE FIELD OF RE J0725-002

The sky was surveyed in the extreme ultraviolet (EUV) region of the spectrum by the EUVE satellite (Malina et al., 1994) and the ROSAT satellite (Pounds et al. 1993) and catalogs of the sources included RE J0725-002 = EUVE J0725-00.4 = BD $-00°1712$ = GSC 4817_468. The star was one of the subjects of an investigation by Jeffries (1995), who concluded from spectral observations that it was a pair of nearly identical K5 dwarf stars orbiting with a $1\overset{d}{.}40$ period.

The automated 0.5-m. telescope, Cousins R filter and CCD camera of the Climenhaga Observatory of the University of Victoria (Robb and Honkanen, 1992) were used to make photometric observations of RE J0725-002. Using IRAF [1] routines the frames were de-biased and flat fielded, and the magnitudes were found from 5 arc second aperture photometry after using the Gaussian centering option of the PHOT package.

The field of stars we observed is shown in Figure 1 and their designations, coordinates (J2000) and magnitudes from the Hubble Space Telescope Guide Star Catalog (GSC) (Jenkner et al., 1990) and the ΔR magnitudes are tabulated in Table 1. The ΔR differences in magnitude are found from our data in the sense of the star minus GSC 4817_386. The standard deviation of the differences during a night ranged from $0\overset{m}{.}006$ for a bright star on a good night to $0\overset{m}{.}030$ for the faint stars on poor nights. The ΔR magnitude given in the table is the mean of the thirteen nightly mean differential magnitudes and the standard deviations measure night to night variations. The stars 4817_468 and 4817_788 have large standard deviations and are variable from night to night. Due to the small field of view extinction effects were negligible and no corrections have been made for them. No corrections have been made to transform the R magnitude to a standard system.

Photometric observations were made from 25 February to 25 March 1996 UT. Brightness variations in RE J0725-002 were evident both during a night and from night to night. A least squares fit of a single sine wave to the data shows a deep minimum in χ^2 at a period of $1\overset{d}{.}404$. A period finding routine based on that of Jurkevich (1971) found the best period to be $1\overset{d}{.}412$. Two other possible periods are rendered less likely by the spectral observations (Jeffries 1995); namely $0\overset{d}{.}5836$, which is a one cycle per day alias, and $2\overset{d}{.}824$, which is twice the adopted period.

So in agreement with Jeffries (1995) the best ephemeris from our data is:

$$\begin{array}{rl}\text{HJD of Minima} = & 2450137\overset{d}{.}46 + 1\overset{d}{.}412 \times \text{E} \\ & \qquad \pm\overset{d}{.}10 \quad \pm 0\overset{d}{.}024\end{array}$$

A plot of the 1051 differential R magnitudes phased at this period is shown in Figure 2 with different symbols for each of the different nights. While the light curve does show a possible "primary eclipse" the lack of a corresponding secondary eclipse leads us to believe that this is not an eclipsing system; a possibility suggested by Jeffries (1995). We suspect

[1] IRAF is distributed by National Optical Astronomy Observatories, which is operated by the Association of Universities for Research in Astronomy, Inc., under contract to the National Science Foundation

Table 1. Stars observed in the field of RE J0725-002

GSC No.	RA J2000.	Dec. J2000.	GSC Mag.	ΔR Mag.
4817_468	$07^h25^m14^s$	$-00°25'39''$	10.2	$-1.698 \pm .034$
4817_788	$07^h25^m05^s$	$-00°24'24''$	12.4	$-0.767 \pm .130$
4817_386	$07^h25^m15^s$	$-00°27'42''$	10.5	–
4817_508	$07^h24^m59^s$	$-00°24'44''$	13.9	$+2.298 \pm .013$
4817_1294	$07^h25^m02^s$	$-00°24'55''$	12.7	$+1.780 \pm .010$
4817_904	$07^h25^m22^s$	$-00°24'29''$	13.1	$+1.923 \pm .009$
4817_1422	$07^h25^m07^s$	$-00°24'21''$	13.9	$+2.862 \pm .018$

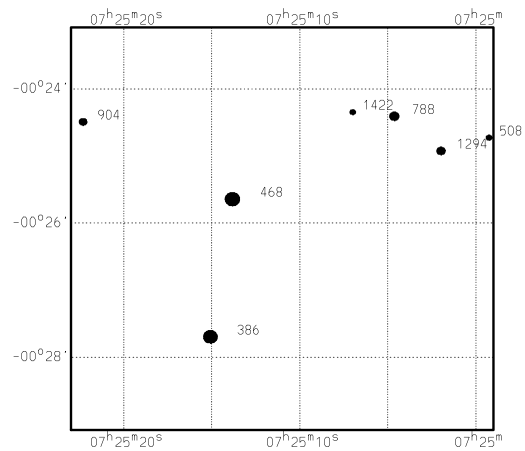

Figure 1. Finder chart of the field labeled with the GSC numbers (Jenkner et al., 1990)

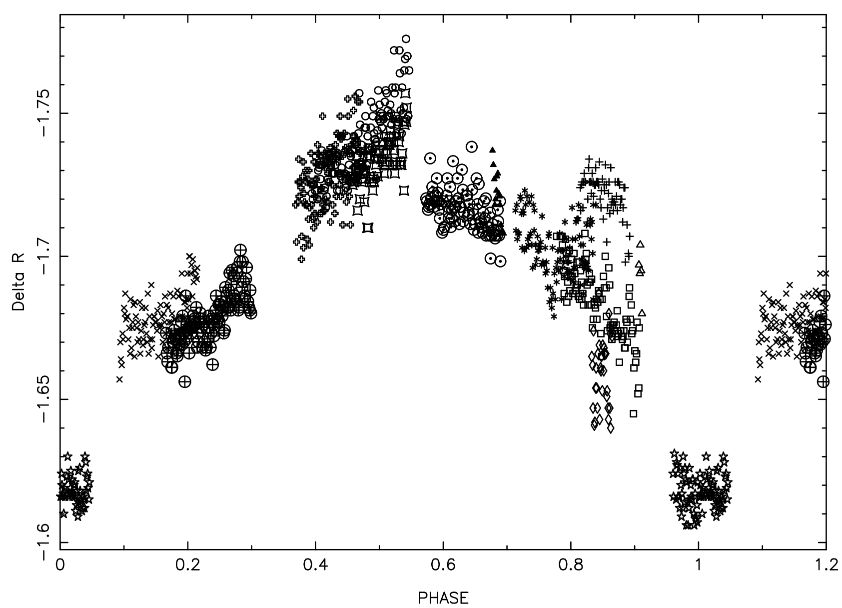

Figure 2. Light curve of the differential R data of RE J0725-002 for 1996

Table 2. Differential observations of GSC 4817_788

HJD	ΔR	HJD	ΔR	HJD	ΔR	HJD	ΔR
2450138.7	−0.627	2450145.7	−0.646	2450156.7	−0.803	2450165.7	−0.917
2450142.8	−0.619	2450148.6	−0.677	2450160.8	−0.870	2450166.7	−0.928
2450143.8	−0.638	2450154.7	−0.788	2450162.7	−0.887	2450167.7	−0.938
2450144.7	−0.636						

that one or both stars have large active regions on them causing the brightness variations and the large EUV emission. The light curve does show shifts of a few hundredths of a magnitude in mean level from night to night, likely due to differential rotation or active region evolution and could be studied by further photometric observations.

As a possible comparison star GSC 4817_788 was monitored but was found to vary from night to night. The differential R magnitudes are given in Table 2. The star was at maximum brightness on approximately HJD 2450142 and decreased in brightness at roughly $0\overset{m}{.}01$ per day during our observations.

The star GSC 4817_508 was also found to vary in brightness during a night. Using a period finding routine based on that of Jurkevich (1971) our best estimate is 3.465 cycles per day. Using the method of Kwee and Van Woerden (1956), Heliocentric Julian dates of primary minimum were found to be 2450144.6908 and 2450154.7935 and times of secondary minimum were 2450142.8352, 2450145.7157 and 2450156.6867. The precision of the minima determinations were nominally $\pm 0\overset{d}{.}0010$, but this does not include an allowance for the asymmetry of the minima. In Figure 3 the data are plotted as a function of phase according to the ephemeris:

$$\text{HJD of Minima} = 2450138\overset{d}{.}64 + 0\overset{d}{.}2886 \times E$$
$$\pm\overset{d}{.}10 \pm 0\overset{d}{.}0005$$

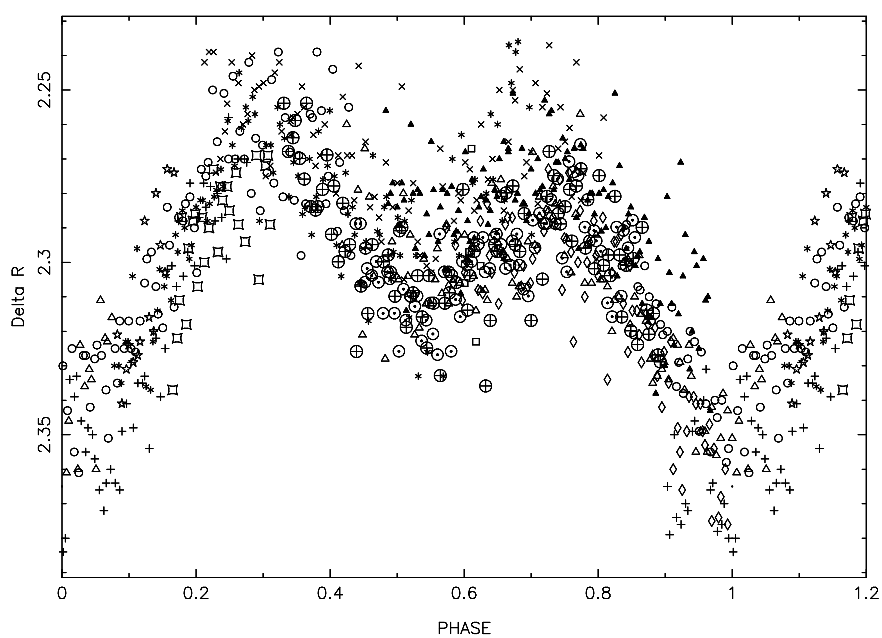

Figure 3. Light curve of the differential R data of GSC 4817_508 for 1996

To help classify the two serendipitously discovered variable stars color information was sought. Unfortunately only a V frame and an I frame were obtained under non-photometric conditions. While not definitive they are indicative of the type of stars. Assuming RE J0725-002 has the V−I of a normal K5V (Jeffries 1995), then GSC 4817_788 is an extremely late M star and GSC 4817_508 has the color of approximately an early K star. Therefore GSC 4817_788 is likely a long period or irregular variable and GSC 4817_508 is most likely an ellipsoidal or eclipsing binary and not a Delta Scuti type star. The shape of the light curve, small amplitude and difference in maxima are consistent with a W UMa star seen with a small inclination.

Further photometric and spectroscopic observations will be valuable to confirm our conclusions as to the reason for the variability of these stars.

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VARIABLE STARS IN THE GLOBULAR CLUSTER M72

NGC 6981 (M72), l= $35^\circ\!.2, b = -33^\circ\!.7$, is a variable-rich Oo IA cluster. The cluster is classified as CC IX (concentration class) and according to Kukarkin (1974) has a radius $R = 2'\!.94$. The list of 42 stars in the Third Catalogue of Variable stars (Sawyer-Hogg 1973) contains 28 RR Lyrae variables with known periods, 11 with no period determinations, 2 non-variables and one red variable (V42). The four variables (V2, V27, V35, V39) detected at larger distances $3'\!.6 \leq R \leq 5'\!.2$, all have a positive X coordinate. Periods have been determined for the first three and hence there are 25 known RR Lyr variables with $R \leq 2'\!.5$. A comparison of the position of the stars on the reproduced plates with the accompanying lists of Shapley (1920), Shapley and Ritchie (1920) and Sawyer-Hogg (1953) indicates that the X coordinates of V29 and V41 should have an opposite sign, i.e. minus and plus correspondingly. These errors have not been corrected in catalogue of Sawyer-Hogg (1973).

During the past 40 years no further search had been made for variable stars in this cluster and no periods were determined for 13 (V6, V19,V22, V26, V30, V33, V34, V36 - V41). In order to check the variability of the 11 stars with unknown periods and search for as yet undetected variables the method proposed and applied for M3 (Kadla & Gerashchenko, 1982) was used. It is based on an analysis of a color–magnitude diagram obtained from measurements of two plates (or CCD) taken "simultaneously". A variable is thus at identical phase and the RR Lyrae stars are located in a definite strip. By indicating the possible variables the diagram considerably narrows down the number of stars which need further investigation.

We had at our disposal a pair of the necessary CCD (B,V) exposures obtained with the 90 cm Dutch telescope at La Silla. Details on the observations, methods of reduction are given in the paper by Brocato et al. (1996). The field includes 33 stars with $R < 2'\!.5$ in the variable star list (Sawyer-Hogg, 1973). Photoelectric standards obtained by Dickens (1972) were used to transform the instrumental magnitudes. The resulting V – (B−V) diagram (Figure 1) includes 239 stars in the magnitude range $15^{m}\!.50 < V < 18^{m}\!.00$, the known variable stars being denoted by an asterisk.

The positions of V6, V19 and V33 on the color–magnitude diagram indicate that they belong to the GB. Of the four stars (V13, V22, V26 and V34) located in the vicinity of the RHB stars only V13 has a known period, V22 is listed as a non-variable and the last two are most probably RHB stars. It was difficult to identify the 5 variables with $R \leq 0'\!.4$ found by Sawyer-Hogg (1953). The reproduced plate of the cluster does not have the necessary quality and no known variables are marked, although according to the listed coordinates V40 is located close to the known variable V13.

The coordinates, V and B−V of the 9 suspected variable stars in the RR Lyr variability strip are given in Table 1. Their positions were determined using as a reference frame the coordinates system given in the catalogue of Sawyer-Hogg (1973).

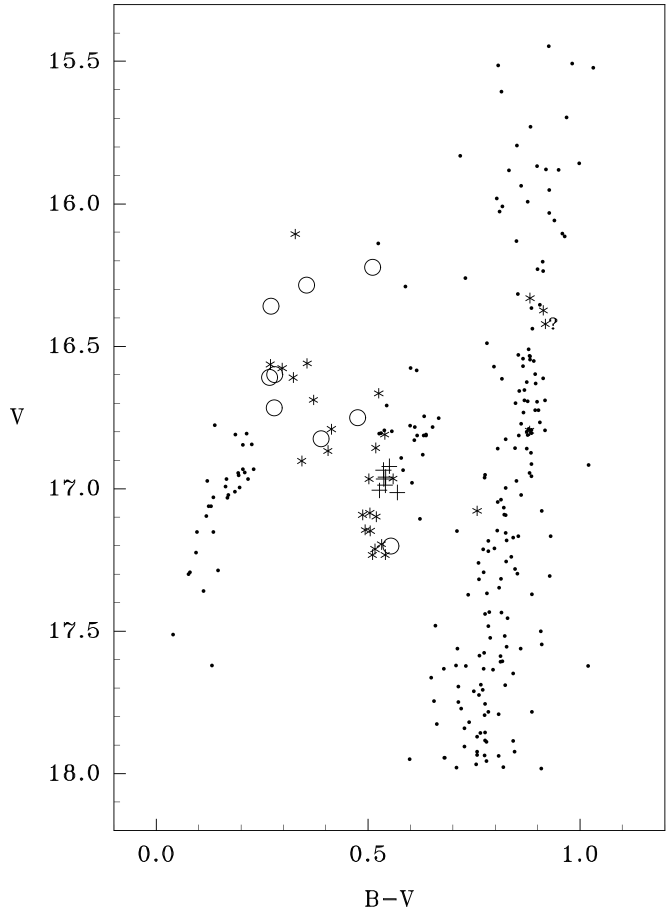

Figure 1. The color–magnitude diagram for the globular cluster NGC 6981. The known RR Lyrae stars are denoted by asterisks, the stars from Table 1 (S) - circles , (R) - pluses.

Table 1. Positions and photometric data for suspected variables (S) and for possible variable stars located at the intersection with the RHB(R)

N	X (arcsec)	Y (arcsec)	V	$B-V$	N	X (arcsec)	Y (arcsec)	V	$B-V$
S1	−44.9	−36.5	16.60	0.27	R1	−68.2	−102.6	16.92	0.54
S2	−15.9	−9.5	16.83	0.38	R2	−34.9	−55.4	16.99	0.53
S3	−10.0	−4.5	16.61	0.26	R3	−23.4	−9.2	17.01	0.56
S4	−0.4	−11.9	17.20	0.54	R4	3.7	6.7	16.97	0.53
S5	0.4	2.7	16.29	0.34	R5	18.2	26.8	17.01	0.52
S6	5.4	−17.5	16.22	0.50	R6	32.3	−12.4	16.93	0.53
S7	9.6	−2.4	16.36	0.26	R7	50.9	−44.4	16.96	0.53
S8	13.6	−9.0	16.72	0.27					
S9	24.9	−9.0	16.75	0.46					

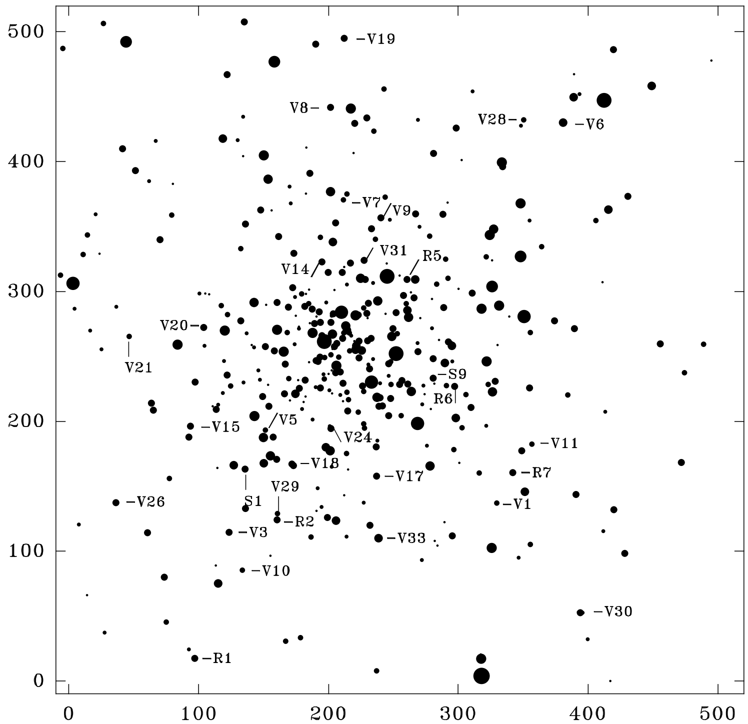

Figure 2. Chart of the cluster. The notations V, S and R preceding the star number refer to known and suspected (Table 1) variables.

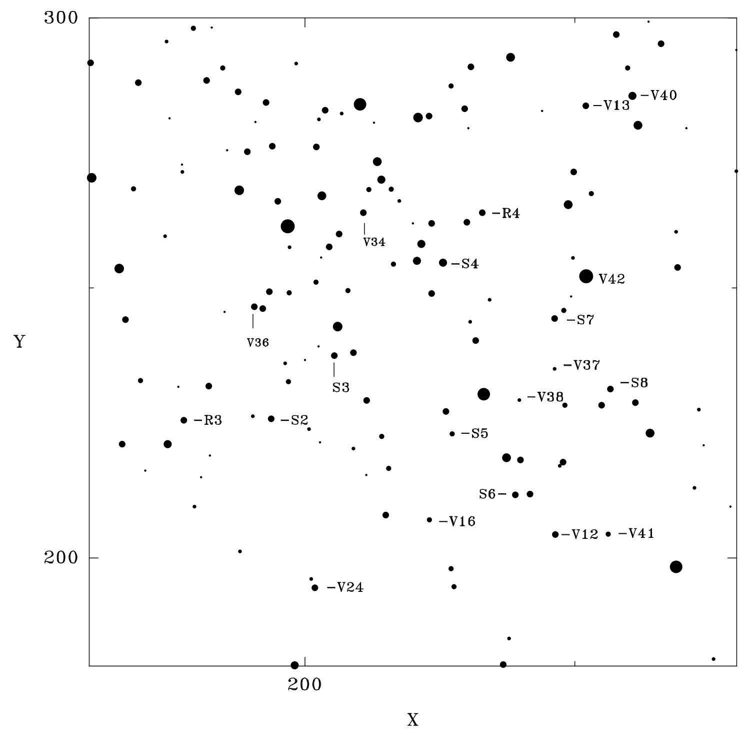

Figure 3. The central part of NGC 6981. The notation are the same as in Figure 2.

As the observed RR Lyrae instability strip slightly intersects the RHB there is a possibility that some of the latter stars are variable. The coordinates, V and B−V of the stars which should be checked are listed in Table 1. The maps of NGC 6981 with known and suspected variable stars are shown in Figure 2 and Figure 3 (coordinates are in pixels, 1 pixel = $0''.44$). Almost all the suspected variables are located in the central part of cluster.

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VARIABLE STARS IN THE GLOBULAR CLUSTER NGC 6681

NGC 6681 (M 70, $C1840-323, l = 2.^{\circ}9, b = -12.^{\circ}5$) is a variable poor Oo II cluster (II VP). With $[Fe/H] = -1.51$ it is one of several clusters which lie in the metallicity interval where alongside with II VP there coexist I VR (Oo I variable rich) clusters. The cluster has an absolute magnitude $M_{v_o} = -7.^{m}05$, concentration class CC = V, apparent radius $r = 3.'9$ (Kukarkin 1974) and limiting radius $r = 11.'0$ (Kukarkin & Kireeva, 1979).

The cluster was first searched for variable stars by Rosino (1962). In the investigated area he discovered five variable stars, three of which are field variables with a distance $r > 11.'7$ from the cluster center. The other two variables, designated V1 and V3, at $r = 2.'0$ and $9.'8$ respectively, were noted by Rosino as RR?, and at the time of publication of the Third Catalogue of Variable Stars in Globular Clusters (Sawyer Hogg 1973) were the only known variables assumed to be cluster members.

A further search for variables was made by Liller (1983). In the investigated field she discovered 18 variables including the five previously detected by Rosino. Three of the variables found by Liller with r = $0.'9$, $5.'9$ and $8.'3$ are within the limiting radius of the cluster. The estimated periods for four of them (excluding V4) enabled their classification as RR Lyrae variables. However according to the "mean" magnitude two of the latter V5 and V2 (renamed Rosino V3) at r = $8.'3$ and $9.'8$ were found to have low probability membership, thus limiting the distance of the three cluster variables at r = $5.'9$. In Liller's table 1 there is a misprint in the signs of the X coordinates of V3 and V4, which should be $-$ and $+$ respectively.

Details of the CCD observations, obtained with the 0.9 m Dutch telescope at ESO-La Silla, methods of reduction are given in the paper by Brocato et al. (1996). The method of a search for as yet undiscovered variables was the same as in the companion paper (Kadla et al., 1996). The V and B magnitudes of the measured stars are based on 16 photoelectric standards (Landolt, 1992) within the magnitude intervals $12.^{m}52 < V < 15.^{m}91$ and $13.^{m}02 < B < 16.^{m}13$ ($-0.^{m}24 < B-V < 1.^{m}91$). CMD was obtained using for the mean V and B magnitudes from 3 V and 3 B consecutive exposures, the time difference between the mean V and B magnitudes being 25 minutes.

The stars in the instability strip of the resulting CMD diagram are shown in Figure 1. The available photometric data (23 exposures - 15 V and 8 B) permitted to confirm the variability of nine stars (including the aforementioned two known RR Lyr variables discovered by Rosino and Liller). Data for these variables (numbered 1 - 12, open circles) and other stars in the instability strip are given in Table 1 and Figure 2. Six stars (Nos. 13 - 18, triangles) are probably variables but need further confirmation and three (Nos. 19 - 21, $V > 16.^{m}36$) are probably field variables. There are three stars (Nos. 22 - 24, asterisks) in the instability strip which did not show any sign of variability in our data. If the variable V4 without a determined period at r = $5.'9$, found by Liller, is included there are at present ten known RR Lyrae stars belonging to the cluster.

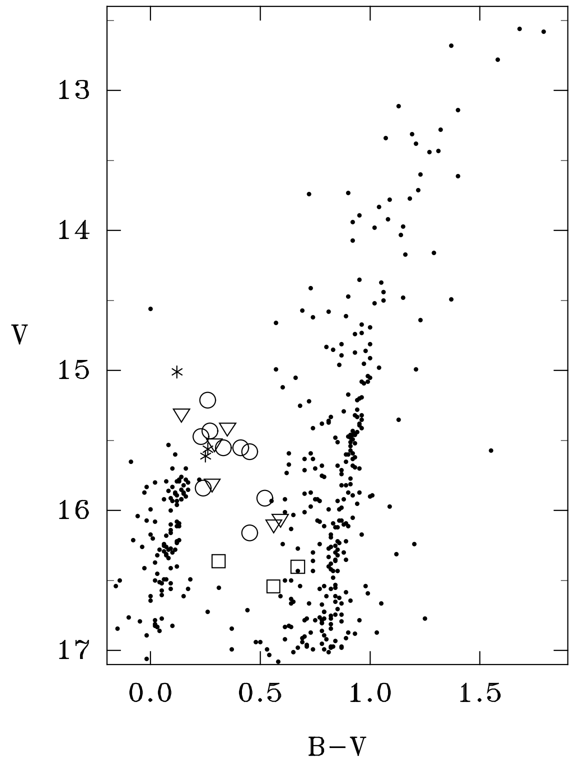

Figure 1. The CMD for stars in an area 3.′8 × 3.′8 centered on the cluster. Concerning notation of stars in the instability strip see the text

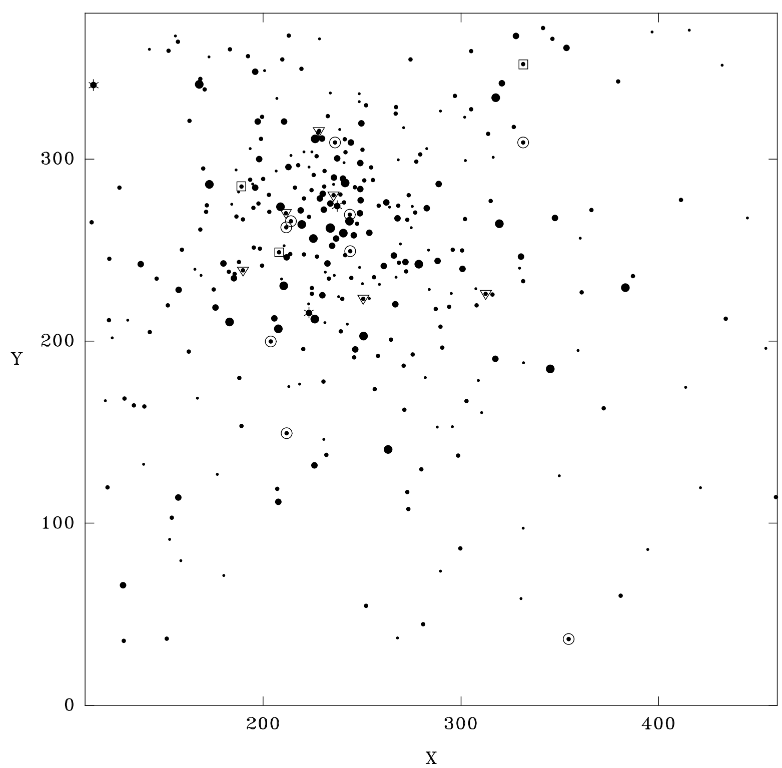

Figure 2. Chart of the cluster showing the position stars in Table 1

Table 1. Photometric data for variables

N	X (arcsec)	Y (arcsec)	V	$B-V$	N	X (arcsec)	Y (arcsec)	V	$B-V$
1	56.4	−105.1	15.58	0.45	13	−19.3	−12.0	16.06	0.59
3	−9.2	−53.2	15.91	0.52	14	−9.4	2.5	15.31	0.14
6	−12.9	−30.0	15.55	0.33	15	−1.6	23.2	15.41	0.35
7	−9.3	−1.2	15.55	0.41	16	1.7	6.9	16.10	0.56
8	−8.2	0.4	15.84	0.24	17	8.7	−19.1	15.52	0.29
9	2.1	20.3	15.47	0.23	18	37.1	−17.9	15.81	0.28
10	5.5	2.1	15.21	0.26	19	−19.7	9.2	16.36	0.31
11	5.6	−7.1	16.16	0.45	20	−10.9	−7.4	16.54	0.56
12	45.9	20.3	15.43	0.27	21	45.9	40.0	16.40	0.67
					22	2.6	4.3	15.01	0.12
					23	−4.0	−22.7	15.56	0.26
					24	−54.1	34.8	15.61	0.25

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ON NOVAE 1982 AND 1986 AND POSSIBLE NOVA 1955 IN M33

Using plates obtained with the 50-cm Maksutov telescope of the Sternberg Astronomical Institute Crimean Laboratory, we studied two novae in M33 discovered by Della Valle *et al.* (1994). These novae were also independently found on our plates.

The coordinates (2000) of the novae are the following:

Nova 1982 (No. 9): $1^h34^m05\overset{s}{.}46$ $+30^\circ46'04\overset{''}{.}6$
Nova 1986 (No. 10): $1^h33^m35\overset{s}{.}70$ $+30^\circ35'03\overset{''}{.}3$

The B magnitudes of the novae based on the photoelectric sequence (Sandage and Johnson, 1974) are given in the table:

Nova 9		Nova 10	
J.D. 2445000+	B	J.D.2446000+	B
229.408	17.9	686.502	(19.2
230.422	18.9	703.361	18.8
234.376	(19.1:	706.358	18.5
239.457	18.9	709.294	(18.5
240.491	18.9	710.294	18.5
257.322	19.2:	712.310	19.2
258.497	19.1:	714.441	(19.2
263.431	19.2		
264.409	(19.3		
265.412	19.2		
266.410	19.3		
267.427	19.3		
285.276	(19.2		
286.403	19.2		
288.396	(19.2		

Nova 9 was seen on 5 plates of Della Valle *et al.* According to our data, the nova was bright on J.D. 2445229 and soon become fainter, but it was still seen for about two months.

Nova 10 was seen on a single plate of Della Valle *et al.* This nova is now confirmed on our plates, though on J.D. 2446710 it was appreciably fainter than according to Della Valle *et al.* ($m_{pg} = 17.8$).

In connection with the search for novae in M33, it is necessary to mention the star 14 B (Humphreys and Sandage, 1980). It was bright in 1955 ($V = 17.20$) and fainter than $V = 22$ in 1977. The star is absent on all (known to us) published photographs of M33, since 1899 (Keeler, 1908). It is not seen on any of our nearly 400 plates with $B_{lim} = 19$ taken in 1971—1996 and on the plate with $B_{lim} = 23$ as a part of Yu.N. Efremov's program at the 6-m Russian telescope in 1986.

It seems that the star 14 B is a nova, and a search for it on plates taken in 1955, if they exist, should be desirable.

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V676 Cen: NEW TIMES OF MINIMA AND A POSSIBLE SHORT PERIOD MODULATION

We present new photoelectric (hereafter pe) minima of the very short period, red, W-type W UMa star V676 Cen = GSC 7806:1187, V $\simeq 11^{\rm m}\!.5$, Sp.T. $\simeq$ K2. Other available minima are the photographic ones (hereafter pg) from the discoverer (Hoffmeister 1956) and the photoelectric ones by Gómez and Lapasset (1988, hereafter GL) and by Gray et al. (1996a, b; hereafter GWS). History, a finder chart, light curves and preliminary elements can be found in GWS. The first period study of V676 Cen was made by Wood and Forbes (1963).

The observations reported here were made in 1983 and 1995 at Cerro Tololo Inter-American Observatory[1] in Chile with the Lowell telescope, refrigerated phototubes, standard UBVRI filters and photon counting techniques. GSC 7806:1222 and GSC 7806:1059 = HD 128433(K2) = CoD $-38°9522$ were used as comparison and check stars, respectively. The derived minima are listed in the lower part of Table 1. The two minima corresponding to the 1983 season were determined through the Sliding Integral's Algorithm (Ghedini 1981, hereafter SIA), while the 1995 minimum was determined by extrapolation using the tracing paper method (Szafraniec 1948). With these minima we have extended the pe baseline of minima from about 4900 in GWS to 15500 cycles.

We made a least squares weighted parabolic solution taking into account all available minima to derive an improved ephemeris and a possible period variation. Standard deviations for the pg minima ($0^{\rm d}\!.005$, $0^{\rm d}\!.010$ and $0^{\rm d}\!.015$) were estimated from a linear solution with equal weights; for the pe minima we used those published by GWS and those from the output of SIA. The standard deviations of the 1995 minimum were estimated visually, while those from GL were estimated as the pg ones ($0^{\rm d}\!.001$, $0^{\rm d}\!.002$ and $0^{\rm d}\!.005$) because they are lacking in the publication. We have taken extreme care to reconcile the pg with the pe minima. The parabolic solution is:

$$\begin{array}{lllll} \text{Min I} = \text{HJD}\,2446971^{\rm d}\!.61072 & + \; 0^{\rm d}\!.29239354 \times E' & - \; 1^{\rm d}\!.76 \times 10^{-11}\, E'^2 & & (1) \\ \qquad\qquad \pm\, 0^{\rm d}\!.00056 & \pm\, 0^{\rm d}\!.00000011 & \pm\, 0^{\rm d}\!.29 \times 10^{-11} & \text{m.e.} & \end{array}$$

Residuals from this solution are labeled (O$-$C)' in Table 1. Those labeled O$-$C are the residuals from the linear solution. As can be seen comparing the linear and parabolic residuals or from (1) the term that takes into account the total variation of the period is only marginally detectable. We might conclude that the system remained stable along the 53134 revolutions (cycles) covered by the available observations. The behavior of the O$-$C residuals is depicted in Figure 1.

[1] Operated by AURA Inc. under cooperative agreement with the NSF.

Table 1. Times of minima and residuals for V676 Cen

Ref.	Min.	Band	HJD (sigma) 2400000+	E	O−C	(O−C)'
1	I	pg	34425.5630(0.0100)	−42908.0	0.0059	0.0069
1	II	pg	34431.5510(0.0050)	−42887.5	−0.0002	0.0008
1	I	pg	34474.3820(0.0050)	−42741.0	−0.0050	−0.0041
1	I	pg	34477.3180(0.0100)	−42731.0	0.0071	0.0079
1	II	pg	34479.5000(0.0050)	−42723.5	−0.0039	−0.0030
1	II	pg	34480.3830(0.0050)	−42720.5	0.0019	0.0028
1	I	pg	34480.5190(0.0100)	−42720.0	−0.0083	−0.0074
1	II	pg	34481.2500(0.0100)	−42717.5	−0.0082	−0.0074
1	I	pg	34481.3950(0.0100)	−42717.0	−0.0094	−0.0086
1	II	pg	34481.5470(0.0050)	−42716.5	−0.0036	−0.0028
1	I	pg	34482.2840(0.0050)	−42714.0	0.0024	0.0032
1	II	pg	34482.4260(0.0050)	−42713.5	−0.0018	−0.0010
1	I	pg	34482.5790(0.0100)	−42713.0	0.0050	0.0058
1	II	pg	34483.3010(0.0050)	−42710.5	−0.0040	−0.0032
1	I	pg	34483.4550(0.0050)	−42710.0	0.0038	0.0046
1	I	pg	34485.4850(0.0100)	−42703.0	−0.0130	−0.0121
1	II	pg	34485.6430(0.0050)	−42702.5	−0.0012	−0.0003
1	I	pg	34486.3650(0.0100)	−42700.0	−0.0101	−0.0093
1	I	pg	34488.4260(0.0050)	−42693.0	0.0041	0.0049
1	I	pg	34489.5920(0.0050)	−42689.0	0.0005	0.0013
1	II	pg	34490.3120(0.0100)	−42686.5	−0.0105	−0.0096
1	II	pg	34490.6190(0.0050)	−42685.5	0.0041	0.0050
1	I	pg	34491.6390(0.0050)	−42682.0	0.0008	0.0016
1	I	pg	34503.3290(0.0050)	−42642.0	−0.0050	−0.0042
1	II	pg	34504.3550(0.0050)	−42638.5	−0.0024	−0.0016
1	I	pg	34505.3800(0.0050)	−42635.0	−0.0008	0.0000
1	I	pg	34508.3140(0.0100)	−42625.0	0.0093	0.0101
1	II	pg	34509.6250(0.0050)	−42620.5	0.0045	0.0053
1	II	pg	34511.3710(0.0050)	−42614.5	−0.0038	−0.0031
1	I	pg	34511.5220(0.0050)	−42614.0	0.0010	0.0017
1	I	pg	34512.3950(0.0050)	−42611.0	−0.0032	−0.0025
1	II	pg	34512.5600(0.0150)	−42610.5	0.0156	0.0163
1	I	pg	34513.2750(0.0050)	−42608.0	−0.0004	0.0003
1	II	pg	34513.4150(0.0050)	−42607.5	−0.0066	−0.0059
1	I	pg	34513.5520(0.0150)	−42607.0	−0.0158	−0.0151
1	II	pg	34514.5800(0.0100)	−42603.5	−0.0112	−0.0104
1	II	pg	34516.3500(0.0050)	−42597.5	0.0045	0.0052
1	I	pg	34516.4930(0.0050)	−42597.0	0.0013	0.0020
1	II	pg	34516.6330(0.0050)	−42596.5	−0.0049	−0.0042
1	I	pg	34517.3700(0.0050)	−42594.0	0.0011	0.0018
1	II	pg	34517.5160(0.0050)	−42593.5	0.0009	0.0016
1	I	pg	34518.2500(0.0050)	−42591.0	0.0039	0.0046
1	I	pg	34518.5400(0.0050)	−42590.0	0.0015	0.0022
1	II	pg	34519.5660(0.0050)	−42586.5	0.0041	0.0048
1	II	pg	34521.6100(0.0050)	−42579.5	0.0014	0.0021
1	II	pg	34529.2260(0.0150)	−42553.5	0.0151	0.0158
1	I	pg	34530.2250(0.0100)	−42550.0	−0.0093	−0.0086
1	II	pg	34531.2480(0.0100)	−42546.5	−0.0097	−0.0090
1	I	pg	34532.2790(0.0050)	−42543.0	−0.0020	−0.0013
1	II	pg	34532.4170(0.0100)	−42542.5	−0.0102	−0.0095
1	II	pg	34533.3040(0.0050)	−42539.5	−0.0004	0.0003
1	I	pg	34533.4460(0.0050)	−42539.0	−0.0046	−0.0039
1	I	pg	34534.3290(0.0050)	−42536.0	0.0012	0.0019
1	II	pg	34534.4760(0.0050)	−42535.5	0.0020	0.0027
1	II	pg	34535.3400(0.0100)	−42532.5	−0.0112	−0.0105
1	I	pg	34535.4910(0.0050)	−42532.0	−0.0064	−0.0057
1	II	pg	34536.2300(0.0050)	−42529.5	0.0016	0.0023

Table 1 (cont.)

Ref.	Min.	Band	HJD (sigma) 2400000+	E	O−C	(O−C)'
1	I	pg	34536.3730(0.0050)	−42529.0	−0.0015	−0.0009
1	II	pg	34537.4010(0.0050)	−42525.5	0.0031	0.0037
1	II	pg	34538.2800(0.0050)	−42522.5	0.0049	0.0056
1	I	pg	34538.4340(0.0150)	−42522.0	0.0127	0.0134
1	I	pg	34539.2950(0.0050)	−42519.0	−0.0035	−0.0028
1	II	pg	34539.4500(0.0050)	−42518.5	0.0053	0.0060
1	II	pg	34540.3210(0.0050)	−42515.5	−0.0009	−0.0002
1	I	pg	34541.3400(0.0050)	−42512.0	−0.0053	−0.0046
1	II	pg	34541.4890(0.0050)	−42511.5	−0.0024	−0.0018
1	I	pg	34542.2250(0.0050)	−42509.0	0.0026	0.0032
1	II	pg	34543.2410(0.0050)	−42505.5	−0.0048	−0.0042
1	I	pg	34543.3890(0.0050)	−42505.0	−0.0030	−0.0024
1	II	pg	34546.4650(0.0050)	−42494.5	0.0029	0.0035
1	I	pg	34562.4000(0.0050)	−42440.0	0.0024	0.0030
1	I	pg	34564.4430(0.0050)	−42433.0	−0.0014	−0.0008
1	II	pg	34565.4580(0.0100)	−42429.5	−0.0098	−0.0092
1	II	pg	34566.3500(0.0050)	−42426.5	0.0050	0.0056
1	II	pg	34568.3950(0.0050)	−42419.5	0.0033	0.0039
1	I	pg	34569.4230(0.0100)	−42416.0	0.0079	0.0085
1	I	pg	34570.3000(0.0100)	−42413.0	0.0077	0.0083
1	II	pg	34571.3140(0.0050)	−42409.5	−0.0017	−0.0011
1	I	pg	34571.4600(0.0050)	−42409.0	−0.0019	−0.0013
1	I	pg	34572.3340(0.0050)	−42406.0	−0.0050	−0.0045
1	II	pg	34572.4830(0.0050)	−42405.5	−0.0022	−0.0017
1	II	pg	34573.3550(0.0050)	−42402.5	−0.0074	−0.0068
1	I	pg	34573.5130(0.0050)	−42402.0	0.0044	0.0050
2	I	U	45434.7866(0.0012)	−5256.0	0.0019	−0.0032
2	I	B	45434.7862(0.0010)	−5256.0	0.0015	−0.0036
2	I	V	45434.7864(0.0010)	−5256.0	0.0017	−0.0034
2	I	U	45435.6633(0.0009)	−5253.0	0.0014	−0.0037
2	I	B	45435.6634(0.0009)	−5253.0	0.0015	−0.0036
2	I	V	45435.6636(0.0010)	−5253.0	0.0017	−0.0034
3	II	pe	46965.6195(0.0010)	−20.5	0.0048	0.0028
3	II	pe	46965.6199(0.0010)	−20.5	0.0052	0.0032
3	II	pe	46965.6167(0.0050)	−20.5	0.0020	0.0000
3	I	pe	46971.6167(0.0020)	0.0	0.0080	0.0060
3	I	pe	46971.6167(0.0020)	0.0	0.0080	0.0060
3	I	pe	46971.6155(0.0010)	0.0	0.0068	0.0048
3	II	pe	46973.5174(0.0020)	6.5	0.0081	0.0061
3	II	pe	46973.5163(0.0010)	6.5	0.0070	0.0050
3	II	pe	46973.5184(0.0020)	6.5	0.0091	0.0071
3	II	pe	46975.5618(0.0010)	13.5	0.0057	0.0038
3	II	pe	46975.5607(0.0020)	13.5	0.0046	0.0027
3	II	pe	46975.5617(0.0020)	13.5	0.0056	0.0037
3	II	pe	46978.4869(0.0010)	23.5	0.0069	0.0049
3	II	pe	46978.4867(0.0010)	23.5	0.0067	0.0047
3	II	pe	46978.4858(0.0010)	23.5	0.0058	0.0038
3	I	pe	47007.5860(0.0050)	123.0	0.0128	0.0109
3	I	pe	47007.5814(0.0010)	123.0	0.0082	0.0063
3	II	pe	47008.6001(0.0050)	126.5	0.0035	0.0016
3	II	pe	47008.6011(0.0050)	126.5	0.0045	0.0026
4	I	BVRI	48393.5174(0.0001)	4863.0	−0.0045	−0.0027
4	I	BVRI	48394.6872(0.0001)	4867.0	−0.0043	−0.0025
5	I	V	49961.6375(0.0015)	10226.0	0.0054	0.0123
5	I	R	49961.6310(0.0025)	10226.0	−0.0011	0.0058
5	I	I	49961.6350(0.0025)	10226.0	0.0029	0.0098

References: 1) Hoffmeister; 2) 1983 minima; 3) GL minima; 4) GWS minima; 5) 1995 minimum.

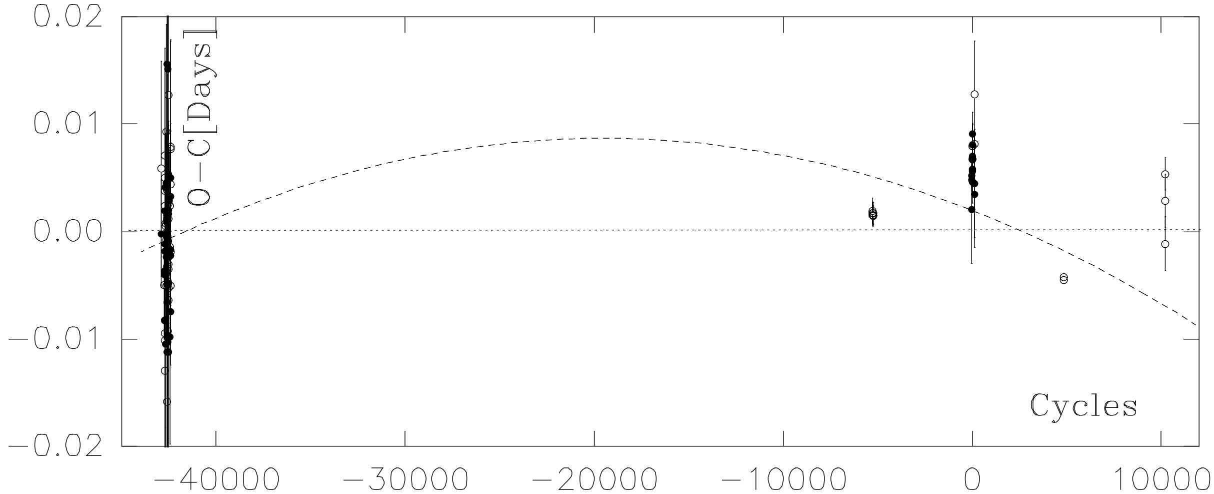

Figure 1. Behavior of the O−C residuals for V676 Cen from Formula (1). Hollow circles stand for primary minima

As can be seen in the pe residuals of Figure 1 there appears to be a modulation of semi-amplitude of $0^{d}.003$ and a period of about 10 years. This might be explained on one hand by a third-body light-time effect (Mayer 1990). On the other hand, as noted in GWS, the O'Connell effect present in their light curves at phase 0.25 is interchanged in GL (phase 0.75), so some mechanism, in particular related to magnetic activity in this late type star, might be responsible for the period modulation (van't Veer 1991, Applegate 1992). However, due to the scanty material analyzed here, new pe times of minima will only give a conclusive answer about this point. The author would like to thank the staff and Director of CTIO for their hospitality.

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A REVISION OF DOLIDZE'S "LIST OF PROBABLE LONG-PERIOD VARIABLES OF M TYPES..."

The following table constitutes a revision of the star list appearing in an obscure paper by Dolidze (1975) concerning spectral peculiarities of M stars and the possibility of using these to predict the type of variability. I became interested in using the list to get visible-light identifications and spectral types for IRAS sources. The original publication includes a list of spectral types determined on red-light objective-prism plates for 191 stars plus seven supplemental stars. About half of these were known or suspected variables, but the remaining 'probable' variables appear to have been observed for the first time, at least for spectral type.

A large number of errors were found in the paper, so a complete revision seemed necessary in order to make the IRAS identifications. In particular, the positions supplied by Dolidze are commonly in error by $5'$ or more. Luckily, finder charts from objective-prism plates are shown for each star, which were necessarily relied upon to identify them. I was able to match these with digitized sky survey images in all but two cases. The revised list provides precise positions for the remainder, with identifications from the IRAS and Guide Star Catalogues where possible, plus links with other names available through the SIMBAD database. For many of the known variables, precise positions are provided for the first time, among which are substantial corrections to the GCVS4 (Kholopov *et al.* 1985).

The procedure was simply to compare Dolidze's finder charts against the digitized sky survey using the Goddard SkyView facility (McGlynn *et al.* 1994, Scollick 1995) and SIMBAD. The original charts cover $12'$ square. Matching star fields was usually unambiguous. I then did searches in SIMBAD around the position estimated from SkyView for IRAS sources and other previously published names as well as GSC positions. For stars with large Dolidze position errors, often the reverse procedure proved successful: calling up SkyView images centered on various IRAS sources near the nominal location. When a GSC identification was made, its position was adopted. Positions for stars missing from the GSC were taken most often from the U. S. Naval Observatory UJ1.0 or A0.9 catalogues (Monet *et al.* 1994, Monet 1996), although in a few cases I derived them from SkyView frames at large image scale.

The table shows Dolidze's designation (from his Tables 3 and 4) in the first column, followed by the equinox 2000 position, the coded source of the position (A = A0.9, G = GSC, P = PPM, S = SkyView, U = U1.0), and IRAS and GSC numbers as available. The spectral types are from Dolidze, being mean values if types were determined on more than one plate. The types were assigned usually only in odd-numbered increments (M3, M5, M7, etc.), but with many intermediate values (*e.g.* M5-7). I have taken this to mean the types are not highly accurate, although comparison with other published values suggests there are neither gross systematic errors nor much scatter in the types, especially considering that all the stars are surely variable and observed at random phases.

Table 1

[D75]	RA (2000)	Dec	s	IRAS	GSC	spec	Remarks
1p	4 20 47.1	+20 54 24	G		1276-0352	C:	
2p	5 46 40.7	+9 23 20	G		0719-0991	C:	
3p	5 52 27.1	+8 57 18	G	05497+0856	0716-0136	M3S	
4p	6 43 56.3	+1 44 59	A	06413+0148		M3/5S	S1* 170
5p	6 44 18.7	+1 55 01	A	06416+0158		C:	CGCS 376
6p	23 17 17.4	+63 22 30	G	23151+6305	4283-0114	M1/3S:	
7p	0 03 34.6	+67 12 59	U	00010+6656		dM5e	
1	0 07 05.6	+61 48 55	G	00044+6132	4014-0314	M5/7	V658 Cas
2	0 17 56.3	+59 09 15	U	00152+5852		M5/7	V659 Cas
3	0 23 17.2	+62 21 39	G	00205+6204	4019-2516	M5	
4	0 27 10.7	+63 33 24	G	00243+6316	4019-1440	M5	
5	0 28 46.2	+63 52 36	G	00259+6335	4023-0332	M5/7	
6	0 34 26.5	+64 32 52	G	00315+6416	4024-1176	M3/5SC:	V660 Cas
7	0 44 17.0	+60 42 20	G	00413+6025	4016-0347	M5/7	NSV 274
8	0 48 07.0	+60 20 19	G	00451+6003	4016-1895	M5/7	
9	0 54 26.1	+63 33 21	G	00513+6317	4021-0393	M5/7	BL Cas
10	1 34 25.8	−18 58 28	G	01320-1913	5854-0287	M7	AP Cet
11	3 30 03.2	+35 40 17	G	03268+3529	2354-1581	M7	R Per
12	3 49 34.8	+51 03 57	G	03458+5054	3338-0022	M8	AP Per
13	3 54 02.3	+36 32 18	G	03507+3623	2369-0278	M5/7	
14	4 02 33.4	+28 29 52	G	03594+2821	1825-0286	M5	
15	4 08 11.8	+26 35 54	G	04051+2627	1822-1275	M3	TX Tau
16	4 11 42.4	+26 27 18	G	04086+2619	1823-0250	M3/5	
17	4 11 48.1	+29 23 26	G	04086+2915	1827-1174	M3/5	see note
18	4 15 37.7	+35 12 26	G	04123+3504	2379-1135	M7	
19	4 15 40.7	+35 31 59	G	04123+3524	2379-0693	M3/5S:	NSV 1531
20	4 21 11.0	+25 53 00	G	04181+2545	1820-0620	M5/7	V412 Tau
21	4 25 17.4	+28 04 41	G	04221+2757	1824-0840	M5	
22	5 20 55.4	+35 05 21	G	05176+3502	2398-0293	M5	EE Aur
23	5 21 24.1	+20 44 27	G	05184+2041	1308-0034	M5	
24	5 22 25.2	+22 44 26	G	05193+2241	1847-0895	M7	
25	5 26 54.6	+36 54 11	G	05235+3651	2415-1199	M5/7	W Aur
26	5 28 23.2	+8 41 28	G	05256+0839	0700-0875	M5	V440 Ori
27	5 34 26.5	+20 22 53	U	05314+2020		M3/5	
28	5 40 00.7	+28 42 49	A	05368+2841		M5	AW Aur = PEP 18
29	5 40 07.9	+37 38 10	A	05367+3736		M7/9	RU Aur
30	5 44 04.9	+6 57 16	G	05413+0656	0127-0715	M5	V520 Ori
31	5 51 41.9	+28 18 25	G	05485+2817	1875-2114	M3/5	AZ Tau
32	6 03 25.8	+13 43 56	G	06005+1344	0729-1282	M7/9	DT Ori
33	6 15 34.4	+15 12 22	G	06127+1513	1314-1235	M5	
34	6 48 09.8	+1 58 23	A	06455+0201		M7	see note
35	6 53 36.0	−5 42 02	G	06511−0538	4813-0430	M5	
36	6 59 28.9	−2 20 09	G	06569−0215	4805-1671	M5	
37	7 12 53.4	−4 09 32	A	07104−0404		M5	
38	7 23 09.3	+13 06 05	G	07203+1311	0771-0003	M5	V Gem
39	7 24 51.0	+12 08 17	G	07220+1214	0772-1474	M5	
40	7 34 00.4	+11 44 07	G	07312+1150	0773-0757	M7	T CMi
41	8 24 55.4	+37 06 53	G	08216+3716	2489-1344	M7	CLS 4
42	8 37 37.2	+39 58 04	G		2975-1484	M7	
43	15 59 23.8	−23 46 24	G	15564−2337	6779-1681	M7	BK Sco
44	16 02 27.8	−26 22 18	A			M7	
45	16 02 42.7	−26 54 38	G	15596−2646	6787-2279	M7	NSV 7398
46	16 02 47.1	−26 25 24	A			M7	
47	16 03 44.1	−26 25 02	U	16006−2616		M7/9	see note
48	16 04 16.6	−25 21 51	G	16012−2513	6784-0956	M5	
49	16 08 28.8	−22 04 31	G	16055−2156	6213-0571	M7	UV Sco
50	16 13 12.9	−24 56 16	G	16101−2448	6797-0345	M5/7	
51	16 15 40.3	−25 01 02	A	16126−2453		M5	UZ Sco
52	16 17 22.0	−24 55 31	G	16143−2448	6797-0098	M3/5	
53	16 18 05.5	−21 49 03	G	16151−2141	6214-1694	M7	VW Sco

Table 1 (cont.)

[D75]	RA (2000)	Dec	s	IRAS	GSC	spec	Remarks
54	16 19 24.6	−22 21 18	A			M3/5	VY Sco
55	16 20 45.2	−21 06 26	A	16178−2059		M5/7	
56	16 20 58.0	−21 31 18	G	16180−2124	6214-1096	M3/5	NSV 7639
57	16 29 26.4	−19 20 51	G	16265−1914	6211-0430	M7/9	Y Sco
58	17 45 18.4	−17 42 01	A	17423−1740		M7	see note
59	17 45 48.1	−16 07 08	A	17429−1606		M7	FK Sgr
60	17 49 17.7	+24 59 08	G	17472+2459	2081-0566	M5	EK Her, see note
61	17 57 03.0	−19 20 16	A	17540−1919		M7	VV Sgr
62	18 05 33.2	−13 53 18	G	18027−1353	5687-0504	M5	BE Ser
63	17 58 43.0	−16 35 54	A	17558−1635		M7	
64	18 08 41.9	+32 02 06	G	18068+3201	2625-0410	M7	PS Her
65	18 11 57.8	+32 27 54	G	18101+3227	2626-1277	M3/5	FL Her
66	18 20 17.3	−16 28 01	G	18173−1629	6265-2290	M5	
67	18 21 37.4	−17 11 07	A	18187−1712		M7	
68	18 22 40.2	−19 23 33	A	18197−1925		M5	
69	18 23 22.8	−12 40 52	G	18205−1242	5698-2284	M3/5	FR Sct
70	18 25 00.9	−6 50 57	G	18223−0652	5111-0308	M5	
71	18 25 58.5	−19 41 29	G	18230−1943	6274-0645	M5	V1982 Sgr
72	18 28 19.6	−18 26 08	A	18253−1828		M7:	
73	18 29 02.7	−17 47 01	G	18261−1748	6270-1514	M5	
74	18 26 01.0	+50 55 49	G	18248+5053	3538-0295	M7	CZ Dra = StM 433
75	18 28 48.7	+6 17 53	G	18263+0615	0450-1286	M5	T Ser
76	18 29 41.3	−19 04 03	A	18267−1906		M7:	V1993 Sgr
77	18 30 11.5	−8 11 16	G	18274−0813	5690-1260	M7:	
78	18 30 13.4	+6 16 50	G	18277+0614	0458-0918	M3/5	BP Ser
79	18 31 07.6	+7 00 31	G	18286+0658	0458-0449	M8	BI Oph
80	18 31 32.2	+4 22 52	A	18289+0420		M3S	TY Oph, see note
81	18 32 23.1	−9 55 09	G	18296−0957	5695-0653	M7	VW Sct
82	18 34 49.1	−19 30 41	A	18318−1933		M7	
83	18 34 57.4	−17 14 29	G		6271-0917	M5	
84	18 34 17.7	+7 48 22	G	18318+0745	1024-1698	M7	V623 Oph
85	18 35 23.7	+6 27 36	G	18329+0625	0458-0515	M3/5	V925 Oph
86	18 36 00.6	+7 41 10	G	18335+0738	1024-1462	M5/7	BK Oph
87	18 36 14.5	+5 04 40	G	18337+0502	0454-1452	M5/7	BR Ser
88	18 37 37.1	+7 22 01	A	18352+0719		M7	
89	19 15 47.2	+31 49 31	G	19138+3144	2653-1244	M5/7	
90	19 21 50.1	+32 00 32	G	19199+3154	2658-1662	M7	AN Lyr
91	19 24 48.4	+30 36 03	G		2654-2686	M5	
92	19 25 22.1	+29 15 54	G	19233+2909	2137-0292	M7	
93	19 26 02.4	+31 53 08	A	19241+3147		M7	V456 Lyr
94	19 59 17.1	+41 24 55	U	19575+4116		M5/7	
95	20 02 58.0	+41 31 27	A	20012+4123		M5/7	
96	20 04 46.9	+40 11 54	U	20030+4003		M5/7	
97	20 11 45.9	+38 00 49	G	20099+3751	3151-2691	M3-M7e	
98	20 13 12.2	+41 27 26	G	20114+4118	3159-0739	M5	V431 Cyg
99	20 13 55.9	+39 23 49	G	20121+3914	3155-0689	M3-M7e	IRC +40400
100	20 14 00.1	+43 26 20	G		3163-0973	M5	
101	20 17 59.3	+43 17 43	G	20162+4308	3163-0118	M5	
102	20 21 18.3	+38 12 44	U	20194+3803		M7	IRC +40407
103	20 26 43.0	+40 56 27	A	20249+4046		M5	
104	20 27 22.9	+41 04 50	G	20255+4054	3156-1234	M5	KZ Cyg
105	20 36 57.1	+37 52 34	A	20350+3741		M5/7	V1828 Cyg
106	20 42 21.8	+27 28 47	G	20402+2718	2178-0679	M5/7	EN Vul
107	20 43 50.5	+34 28 49	G	20418+3417	2695-1838	M5	V1975 Cyg
108	20 44 12.4	+26 12 46	U	20420+2601		M7	
109	20 44 31.5	+32 29 32	U	20425+3218		M5/7	V570 Cyg
110	20 46 32.3	+29 26 08	G	20444+2915	2182-0983	M5/7	
111	20 46 09.6	+40 57 58	A			M5	
112	20 48 22.9	+32 40 57	G	20463+3229	2691-2873	M7	

Table 1 (cont.)

[D75]	RA (2000)	Dec	s	IRAS	GSC	spec	Remarks
113	20 49 32.8	+29 47 23	G	20474+2936	2183-0777	M7	
114	20 51 33.8	+28 08 45	G	20494+2757	2183-1590	M7	
115	20 51 52.2	+29 07 49	G	20497+2856	2183-2351	M7	
116	20 52 32.1	+27 10 28	G	20502+2658	2179-1415	M7	UW Vul
117	20 54 39.8	+28 30 12	G	20525+2818	2183-2400	M7	
118	20 55 05.5	+30 24 52	U	20529+3013		M7	UX Cyg
119	20 56 13.6	+36 21 52	G	20542+3610	2700-2803	M5	V1886 Cyg
120	20 59 09.3	+26 48 57	G	20569+2637	2180-0920	M7	
121	20 59 49.4	+26 13 48	G	20576+2602	2176-0027	M7	
122	21 04 17.1	+37 51 07	G	21023+3739	3168-0575	M5/7	LD 37
123	21 06 33.2	+37 32 51	G		3168-0583	M5/7	LD 38
124	21 06 20.9	+41 35 57	G		3176-1825	M7	
125	21 07 29.8	+37 10 45	G		2713-0439	M7	V1804 Cyg
126	21 10 19.3	+39 40 29	G		3173-0157	M8	IRC +40472
127	21 12 59.5	+40 08 37	U			M5/7	V529 Cyg, see note
128	(21 11.5	+39 11)	-			M5/7	see note
129	21 12 48.3	+38 06 42	G		3169-1735	M3-M7	
130	21 14 12.2	+36 39 01	S			M7	
131	21 15 54.8	+38 11 29	U			M5	V479 Cyg
132	21 16 52.9	+41 03 46	G		3173-0556	M7	IRC +40477
133	21 16 06.8	+39 52 31	G		3173-2544	M5/7	
134	21 16 47.2	+36 50 03	G		2714-0558	M5	IRC +40476
135	21 18 40.2	+40 04 08	G		3173-2344	M3/5	
136	21 24 44.3	+38 05 58	G		3182-1658	M7	V473 Cyg
137	21 27 19.2	+36 55 57	G		2716-0960	M7	
138	21 33 30.0	+56 46 48	G		3975-1232	M8	
139	21 35 52.4	+51 14 42	G	21341+5101	3603-0512	M3/5	V1728 Cyg
140	21 35 59.8	+58 27 46	G	21344+5814	3979-1062	M7	
141	(21 43.5	+55 44)	-		M8	see note	
142	21 44 52.6	+58 51 19	G	21433+5837	3979-1510	M5	
143	21 50 02.3	+51 27 56	U	21482+5113		M5	
144	21 52 05.5	+56 45 48	G	21503+5631	3976-1073	M5/7	
145	21 56 19.0	+58 48 23	A	21547+5834		M7	
146	21 56 41.3	+58 53 10	A	21550+5838		M7	
147	21 59 52.2	+57 21 49	G	21581+5707	3976-0717	M5	GN Cep = IRC +60336
148	22 05 28.6	+62 30 11	G	22039+6215	4267-2009	M5/7	TT Cep
149	22 07 30.2	+44 48 53	G		3210-1749	M5	
150	22 16 19.5	+44 16 48	G	22142+4401	3211-1559	M5/7	
151	22 20 08.4	+62 10 14	G	22184+6155	4268-0720	M5/7	NSV 14126
152	22 31 08.1	+55 11 57	G	22291+5456	3987-1158	M6	NV Lac
153	22 34 16.5	+40 53 40	G		3205-0257	M5/7	
154	22 39 38.0	+42 22 18	G	22374+4206	3209-2055	M3/5	
155	22 43 15.6	+42 22 11	P	22410+4206	3222-0674	M7	R Lac
156	22 43 21.0	+41 17 20	G	22410+4101	3222-0149	M7	LD 207
157	22 44 02.9	+42 35 29	G	22418+4219	3222-1335	M5	
158	22 46 20.6	+40 45 00	G	22440+4028	3218-1625	M5	
159	22 49 16.9	+58 35 07	G	22472+5819	3996-0641	M7	AL Cep
160	22 52 35.6	+41 10 55	G	22503+4054	3219-0597	M5/7	
161	22 57 00.4	+57 40 00	G	22549+5723	3993-1301	M7	NSV 14375
162	23 02 13.1	+57 21 44	G	23000+5705	3993-0933	M5/7	
163	23 04 49.6	+56 32 58	G	23026+5616	3993-2216	M5	V343 Cas
164	23 05 27.4	+57 07 46	U	23033+5651		M7	
165	23 08 39.8	+58 18 10	G	23065+5801	4010-1748	M5	same as #167
166	23 07 53.7	+60 19 28	G	23057+6003	4278-0748	M5	IRC +60386
167	23 08 39.8	+58 18 10	G	23065+5801	4010-1748	M5	same as #165
168	23 09 15.4	+60 58 56	G	23071+6042	4279-1734	M3	
169	23 10 43.6	+64 28 53	G	23085+6411	4287-0974	M5	CH Cep
170	23 11 40.6	+59 41 58	P	23095+5925	4010-0907	M5	V Cas
171	23 12 57.0	+60 34 38	U	23108+6018		M5	OQ Cep

Table 1 (cont.)

[D75]	RA (2000)	Dec	s	IRAS	GSC	spec	Remarks
172	23 14 33.6	+57 15 21	U	23123+5658		M5	V397 Cas
173	23 18 43.0	+55 58 25	A	23164+5541		M5	
174	23 21 16.9	+56 04 45	U	23190+5548		M5/7	
175	23 20 43.6	+59 34 19	G	23185+5917	4011-0468	M5	
176	23 22 34.6	+55 43 14	U	23202+5526		M7	NSV 14531
177	23 23 17.8	+57 25 27	U	23210+5708		M5/7	
178	23 24 41.4	+54 55 18	U	23223+5438		M5/7	
179	23 25 45.7	+56 19 08	G	23234+5602	4007-1219	M5	
180	23 25 52.2	+56 27 10	G		4007-1005	M3/5	
181	23 27 34.9	+55 43 18	G	23252+5526	4003-0420	M5	DG Cas
182	23 28 15.4	+60 28 59	G	23259+6012	4280-1884	M5	V580 Cas
183	23 35 50.4	+58 44 19	G	23334+5827	4012-1009	M5	
184	23 37 39.7	+58 50 47	S	23352+5834		M5/7	
185	23 38 40.0	+54 35 18	A			M5/7	
186	23 44 31.5	+56 34 52	A	23420+5618		M5	Z Cas
187	23 46 24.3	+54 29 09	G	23439+5412	4004-0140	M5	RT Cas
188	23 48 13.9	+61 01 55	U	23457+6045		M5	IRC +60424 = EM Cas
189	23 56 44.2	+58 49 02	G	23542+5832	4013-1641	M5	
190	23 57 45.8	+56 06 20	G	23552+5549	4005-0210	M5	
191	23 59 38.5	+59 45 30	G	23570+5928	4013-0847	M5	V335 Cas

Notes
17 CGCS 629; however, not a carbon star (*cf.* Bidelman 1980).
34 ID somewhat uncertain; position is for brightest DSS image.
47 ID somewhat uncertain; alternate star NW has end-figures $43^{s}.8/24'54''$.
58 $-1°$ Dolidze Dec error.
60 also GSC 2081-3600.
80 HD 170831 = CGCS 4032. this is surely a carbon star, Dolidze type wrong.
127 chart identical to #126.
128 can't identify on sky; Dolidze position given.
141 can't identify on sky; Dolidze position given.

For intermediate types (and in taking averages) I have adopted the notation of Houk (see, for example, Houk & Cowley 1975), which uses a slash (*e.g.* M5/7) to indicate uncertainty rather than a truly intermediate spectral class. Note several cases where Dolidze found indications of carbon-star or S-type characteristics (*e.g.* M3S).

The remarks and notes show additional identifications from SIMBAD, particularly variable-star names. In several cases Dolidze has given incorrect variable-star designations, which are herewith corrected.

I appreciate the help of William P. Bidelman in making a number of identifications from his bibliographic file. Two on-line facilities were indispensable for this work: SIMBAD, maintained by the Centre de Données Astronomique, Strasbourg, France; and SkyView, maintained by Keith Scollick of the Goddard Space Flight Center. This work was begun during a stay at the CDS Strasbourg; I gratefully acknowledge the assistance of the staff there.

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COMMISSIONS 27 AND 42 OF THE IAU
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VARIABLE STARS IN THE GLOBULAR CLUSTER NGC 5286

NGC 5286 ($C1343-511, l=311^\circ\!.6, b=+10^\circ\!.6$) is a cluster of intermediate metallicity, as it follows from its spectral class - F5 (Hesser & Shawl, 1985), although a wide range of its values was quoted in the literature: from -1.26 (Samus' et al., 1995) to -1.79 (Brocato et al., 1996). It has the apparent radius $r=4'\!.6$ (Kukarkin, 1974), the tidal radius $r=12'\!.0$ (Webbink, 1985) and the concentration class CC V.

According to the data published in "A Third Catalogue of Variable Stars in Globular Clusters" (SHC) (Sawyer-Hogg, 1973) and later investigation by Fourcade et al. (1978) and Liller & Richten (1978) altogether 16 variables have been discovered within the apparent radius of this cluster. Ten of these stars are classified as RRAB and six as RRC. With Pab and Nc/Nab the cluster is classified as OoII variable-poor (IIVP).

The observational material and the method of search for variable stars are the same as in our previous papers (Kadla et al., 1996a,b). CMD was obtained as in Kadla et al. (1996b) using the mean V and B magnitudes from several consecutive V and B exposures. CMD for stars with $R>0'\!.36$ within the investigated area $5'\!.4\times3'\!.7$ is shown in Figure 1. In the instability strip, besides 10 of the above variables, there are 8 stars which may be RR Lyr variables. The data for the latter stars are given in Table 1. Their positions were determined using as the reference frame the coordinates system given in the catalogue of Sawyer-Hogg (1973). Our photometric data (23 exposures – 12 V and 11 B) permitted to confirm the variability of 5 short-period variable stars and detect variability for 2 suspected variables (N2 and N7 from Table 1). All variables (known and suspected) are shown in the cluster chart (Figure 2).

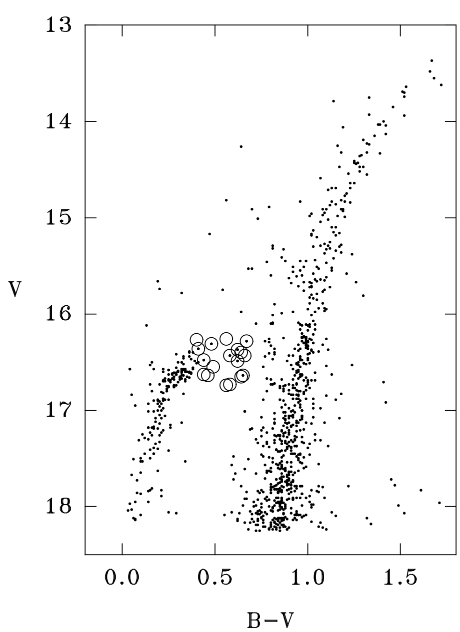

Figure 1. The color - magnitude diagram for the globular cluster NGC 5286. The known RR Lyrae stars are denoted by ◯ , suspected ones by ⊙

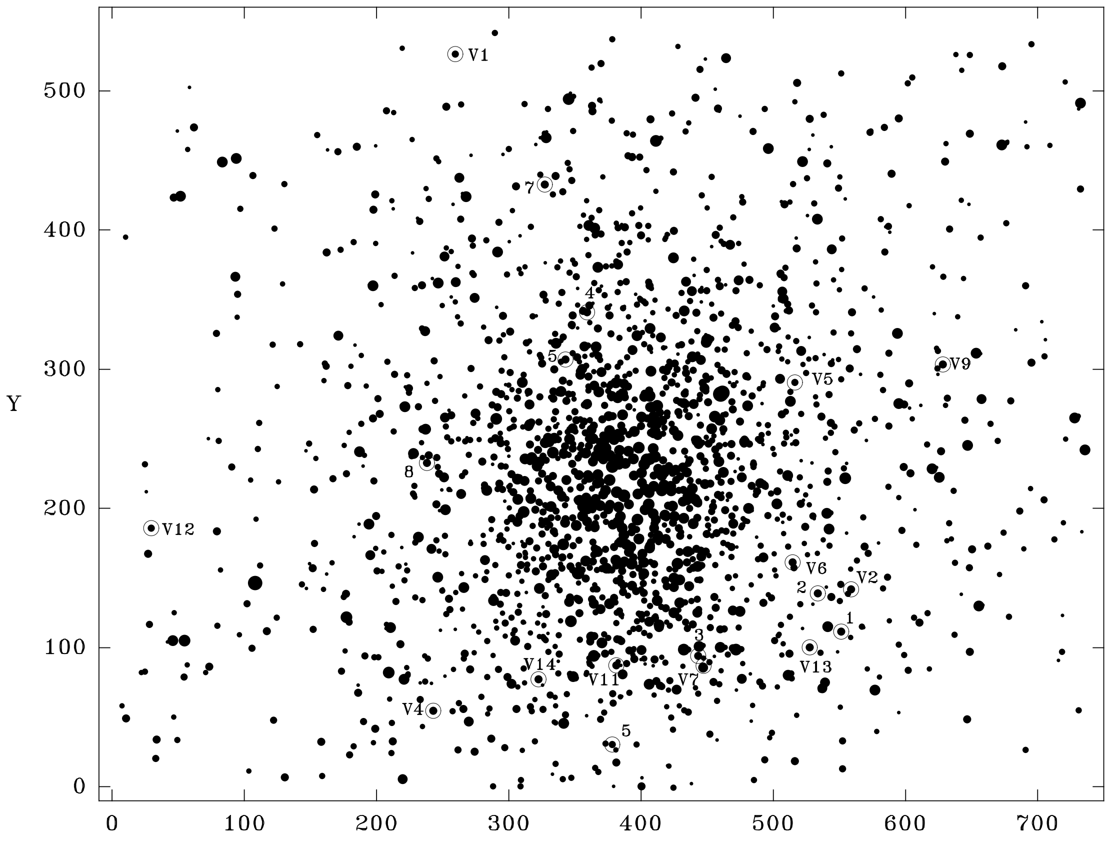

Figure 2. Chart of the cluster. Variable stars are denoted by ◯ . The notations V preceding the star number refer to known variables

Table 1. Positions and photometric data for suspected variable stars

N	X (arcsec)	Y (arcsec)	V	$B-V$	N	X (arcsec)	Y (arcsec)	V	$B-V$
1	74.7	−55.3	16.43	0.58	5	−6.3	56.8	16.36	0.41
2	67.4	−42.1	16.49	0.62	6	−14.9	41.4	16.31	0.48
3	24.3	−59.7	16.28	0.67	7	−18.1	99.8	16.37	0.62
4	−7.6	−86.8	16.64	0.65	8	−65.5	10.9	16.48	0.44

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CORRIGENDA

Correction to IBVS No. 4418: In order to bring to accordance Table 1 and Figure 2, it is necessary to interchange star's Nos. 4 and 5 in Table 1 and to attribute No. 6 to that one of two stars with number 5 in Figure 2 that has coordinates Xpixel=359 and Ypixel=341.

Y. Malakhova

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$UBV(RI)_c$ PHOTOMETRY OF THE RAPIDLY ROTATING K-TYPE STAR HD 197890 = "SPEEDY MIC"[1]

HD 197890 (= SAO 212437 = CPD−37°8883 = RE J204745-363538) was found to be a very strong EUV and X-ray source during the ROSAT all-sky survey, with most of the emission due to a very intense flare event (Bromage et al. 1992; Matthews et al. 1994; Kürster 1995). Optical spectroscopy has revealed that the star is single and shows Ca II H&K emission, a very strong Li I 6708 Å line and a highly variable Hα profile (Bromage et al. 1992; Jeffries 1993). From the vsini value of 120±20 km s^{-1} and optical photometry it was immediately clear that HD 197890 was an extremely fast rotator and it was indeed nicknamed *"Speedy Mic"* (Bromage et al., 1992). So far HD 197890 is the most rapidly rotating nearby single late-type star known.

A *V*-band photometric study was presented by Anders et al. (1993) which, from a total of 62 observations over three nights in 1991 August/September, inferred photometric periods of 0.314 and 0.275 days. They present the whole data set by using the 0.314-day period that, however, produce a quite scattered light curve (see Figure 4 in Anders et al. 1993). They also computed a vsini value of 170±20 km s^{-1} from the analysis of the Li 6707 Å and Ca 6717 Å lines and estimated a K5 spectral type.

In order to further investigate on the rotational period of HD 197890, multicolor photometric observations were carried out over the interval 7-13 October 1996 by using the 0.5m ESO telescope (La Silla, Chile) equipped with a single-channel photon-counting photometer, a thermoelectrically cooled R943-02 Hamamatzu photomultiplier and standard ESO filters matching the $UBV(RI)_c$ system. Accurate differential photometry was obtained with respect to HD 198178 and SAO 212414, that were used as comparison and check stars, respectively. The observations were corrected for atmospheric extinction and transformed to the standard $UBV(RI)_c$ system. Details on the observations and reduction procedures can be found in Cutispoto (1995). The typical error of our differential photometry is of the order of 0.005 magnitudes. We have also obtained the following *V* magnitude and colors for the comparison and check stars:

HD 198178: V=7.96, B−V=1.04, U−B=0.89, V−R_c=0.53, V−I_c=1.01
SAO 212414: V=10.21, B−V=0.65, U−B=0.19, V−R_c=0.36, V−I_c=0.71

The errors on these values are of the order of 0.01 magnitudes.
We have collected a total of 46 $UBV(RI)_c$ photometric observations of HD 197890 that have been analyzed according to the method presented by Scargle (1982), which is essentially a Fast Fourier Transform adapted for unequally spaced data. The highest peak in the periodogram (F1) corresponds to a photometric period of 0.380±0.004 days, i.e. 9.120±0.096 hours (see Figure 1). There is a second significant frequency (F2) in the periodogram that corresponds to a period of 0.303±0.004 days.

[1] based on data collected at the European Southern Observatory, La Silla, Chile

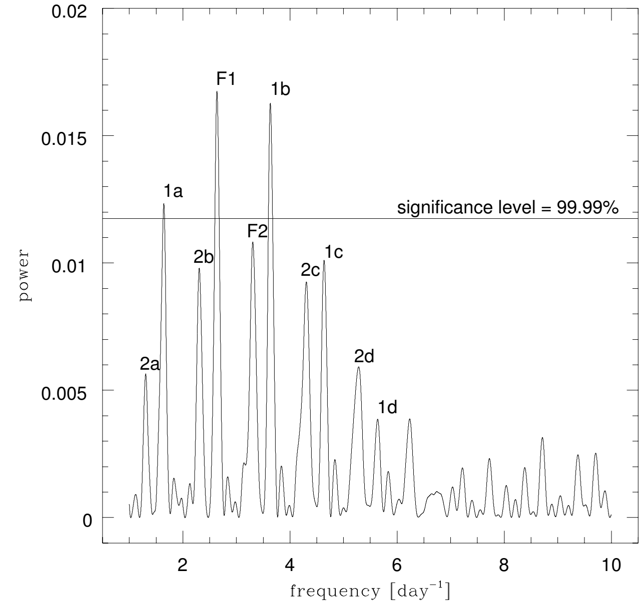

Figure 1. The periodogram obtained for HD 197890. The highest peak (F1) corresponds to a 0.380-day period; the 1a, 1b, 1c and 1d peaks are aliases of the F1 period. A second frequency (F2), corresponding to a 0.303-day period, and its aliases 2a, 2b, 2c and 2d are also visible

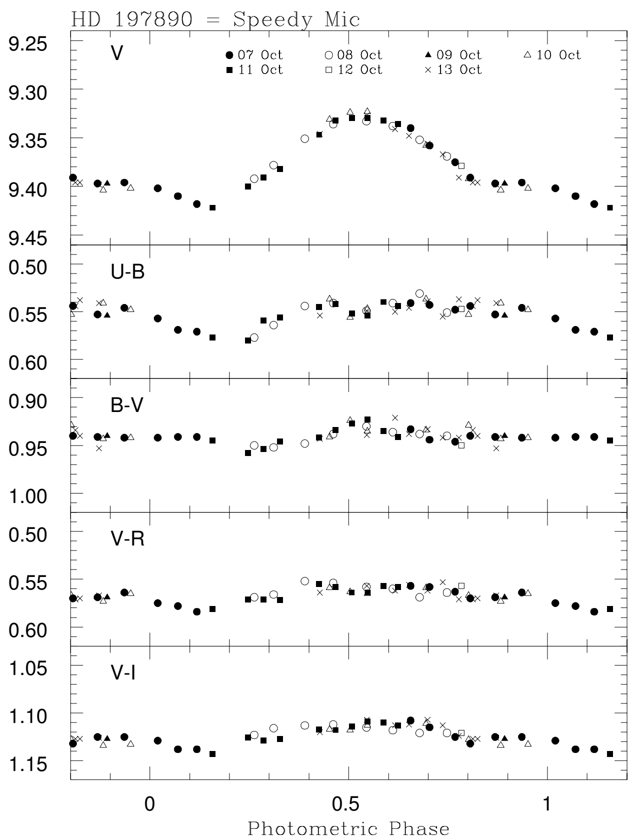

Figure 2. V-band light curve and colors of HD 197890 obtained over the time interval 1996, October 7-13. Phases are reckoned from the photometric ephemeris HJD = 2450000.0 + 0.380 $\times E$

The resulting V-band light curve with a peak-to-peak amplitude of about 0.1 magnitudes is shown in Figure 2, along with color variations that appear in phase with the V-band modulation. Phases are reckoned from the photometric ephemeris:

$$\mathrm{HJD} = 2450000.0 + 0.380 \times E$$

The 0.303-day period produces a rather scattered light curve. Our light curve folded with the 0.380-day period has a smaller amplitude with respect to the Anders et al. (1993) data and presents a maximum and a minimum luminosity that are about 0.025 and 0.14 magnitudes brighter, respectively. We also note that folding the Anders et al. (1993) data with our 0.380-day period a light curve much less scattered than the original one is obtained.

The $B-V$ and $V-R_c$ colors of HD 197890 are consistent with those of a K3 V star, while the $U-B$ and the $V-I_c$ appears too blue and too red, respectively, for such a classification. These differences could be due to a very high activity level, to the fact that HD 197890 has not yet arrived on the main sequence or to both circumstances. However, from the vsini value computed by Anders et al. (1993) and our new photometric period, the minimum stellar radius falls in the range 1.13-1.43 $R_\odot$, thus supporting the hypothesis that HD 197890 is a pre-main sequence star (Anders et al. 1993).

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COMMISSIONS 27 AND 42 OF THE IAU
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NSV 11164 = MINOR PLANET (563) SULEIKA

In the *New Catalogue of Suspected Variable Stars* (Kholopov *et al.*, 1982), it is suggested that NSV 11164 is a minor planet. An investigation by the current author shows that NSV 11164 is the minor planet (563) Suleika.

The original report of NSV 11164 is by Innes (1917a), who located the object, numbered 123 in his list, during a survey of variable stars near R Coronae Austrinae. Innes 123 appears only on a single 60-minute plate, taken by H. E. Wood on 1915 Aug. 6, where it is recorded as being magnitude 14.8. Further details are given in Innes (1917b), where it is stated that the sole image is a 'good stellar image'. It is here that the remark 'Is only image found. Minor pl.?' appears.

An addendum to the initial report remarks that a further plate, a 30-minute exposure by Wood on 1915 Aug. 3, had become available and that comparison of this plate and the plate of Aug. 6 proved that three of the objects identified initially as variable stars were actually minor planets. Innes (1917a) made identifications as follows: Innes 111 = (22) Calliope; 132 = (9) Metis; and 134 = (267) Tirza. The first two identifications are confirmed as correct, but Innes 134 is in reality (131) Vala.

Table 1. Minor-Planet Candidates Reported by Innes

Innes No.	R.A.	Dec.	Equinox	Ref.	MP No.
111	$18^h22^m57\overset{s}{.}8$	$-35°44'27''$	1915	Wood (1917)	(22)
123	18 32 15	−29 01.1	1875	Innes (1917a)	(563)
132	18 55 03.1	−29 01 17	1915	Wood (1917)	(9)
134	18 57 14.7	−29 02 32	1915	Wood (1917)	(131)

Table 2. J2000.0 Coordinates for Minor-Planet Candidates

Innes No.	R.A. (2000)	Dec.	MP No.
111	$18^h28^m40\overset{s}{.}3$	$-35°41'15''$	(22)
123	18 40 11	−28 54.5	(563)
132	19 00 25.3	−28 54 12	(9)
134	19 02 36.8	−28 55 11	(131)

Table 3. Predicted Minor-Planet Positions and *V* Magnitudes

MP No.	R.A. (2000)	Dec.	*V*	Innes No.
(9)	$19^h00^m24\overset{s}{.}8$	$-28°54'13''$	$10\overset{m}{.}2$	132
(22)	18 28 40.3	−35 41 12	11.3	111
(131)	19 02 37.0	−28 55 13	13.5	134
(267)	19 09 57	−28 50.0	14.2	
(563)	18 40 13	−28 54.9	13.2	123

The time of exposure of the Aug. 6 plate was not given by Innes. Wood (1917) later reported precise measurements of the three recognised minor planets from both the Aug. 3 and 6 plates, repeating the misidentification of (131) as (267) and giving the times of mid-exposure as 1915 Aug. 3.78722 UT and Aug. 6.79426 UT.

Table 1 gives the original-equinox measurements for the four Innes objects that are minor planets; Table 2 lists the corresponding J2000.0 coordinates. Table 3 lists the predicted J2000.0 minor-planet coordinates and visual magnitudes for 1915 Aug. 6.79426 UT.

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PHOTOELECTRIC BVI_C OBSERVATIONS AND A NEW CLASSIFICATION FOR V804 ARAE

V804 Ara was included in our program of photoelectric observations for Cepheids because it is classified in GCVS-IV as a possible Cepheid. We observed the star at CTIO during the period September-November 1996 using the 1.0–m reflector. A total of 30 BVI_c measurements were obtained (Table 1), the accuracy of the individual data being near $\pm 0\overset{m}{.}02$ in all filters.

Our observations are plotted in Figure 1. The data indicate a range of light variability of $0\overset{m}{.}50$ in V, $0\overset{m}{.}15$ in $B-V$ and $0\overset{m}{.}30$ in V$-$I$_c$, but the star cannot be a Cepheid because, first, changes in $B-V$ color are asynchronous with the changes in V – which is atypical of Cepheids – and second, it has a very large infrared excess. It seems more likely that V804 Ara is a semiregular variable.

Table 1

JD_{hel} 2450300+	V	B−V	V−I$_c$	JD_{hel} 2450300+	V	B−V	V−I$_c$
48.5687	13.165	1.605	3.325	80.5499	13.471	1.531	3.533
50.6595	13.205	1.595	3.310	81.5341	13.472	1.491	3.527
51.5575	13.118	1.657	3.282	82.5295	13.494	1.486	3.505
52.5768	13.122	–	3.283	83.5303	13.421	1.592	3.493
53.5251	13.073	1.594	3.247	84.5372	13.379	–	3.453
54.5386	13.099	1.594	3.296	85.5161	13.401	1.537	3.477
55.5262	13.079	1.608	3.282	85.5183	13.424	1.565	3.471
57.5245	13.034	1.622	3.258	86.5265	13.330	1.558	3.451
58.5286	13.044	1.618	3.249	87.5219	13.420	1.605	3.473
59.5219	13.049	1.581	3.268	88.5254	13.370	1.560	3.466
60.5278	13.079	1.588	3.279	89.5250	13.302	1.546	3.409
61.5347	13.065	1.650	3.262	90.5201	13.343	1.592	3.453
62.5313	13.093	1.585	3.281	91.5201	13.328	1.540	3.442
63.5327	13.105	1.592	3.305	92.5142	13.303	1.623	3.422
79.5499	13.424	1.562	3.499	93.5171	13.325	1.617	3.435

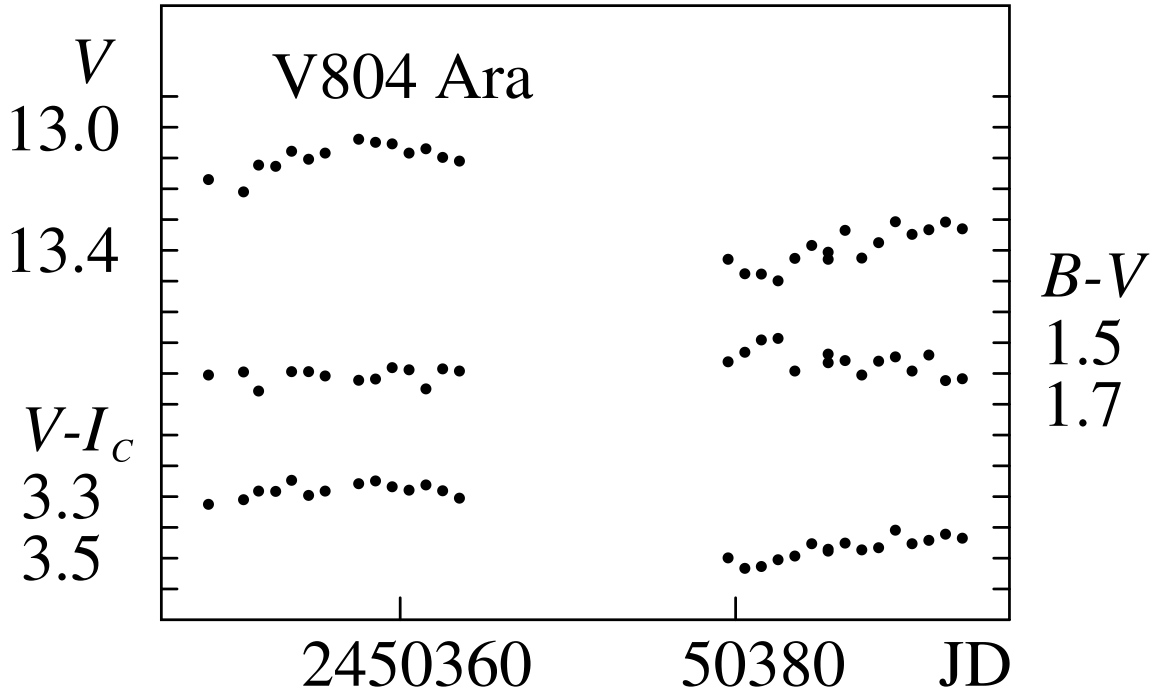

Figure 1

The research described here was made possible in part by grants No. 95–02–05276 and No. 94–02–04347 from the Russian Foundation of Basic Research to LNB and through NSERC Canada to DGT. The authors were Visiting Astronomers at Cerro Tololo Inter-American Observatory, National Optical Astronomy Observatories, which is operated by the Association of Universities for Research in Astronomy, Inc. (AURA) under co-operative agreement with the National Science Foundation.

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PHOTOELECTRIC BVI_c OBSERVATIONS FOR THE RS CVn STAR GR NORMAE

GR Nor is classified in GCVS-IV as a Cepheid (CEP type) with the elements

$$MaxJD_{hel} = 2444145.82 + 1.960002 \times E.$$

GR Nor was included in our program of photoelectric observations for Cepheids because there are few published observations for the star, and hence it is impossible to construct a good light curve for it. We observed the star at CTIO during the period September – November 1996 using the 1.0-m reflector. A total of 25 BVI_c measurements were obtained (Table 1), the accuracy of the individual data being near $\pm 0\overset{m}{.}01$ for all filters.

The observations are plotted in Figure 1a using the above elements. A comparison of our observations with published data by Walraven *et al.* (1958), Harris (1980) and Diethelm (1986) — Figures 1b–1d — suggests that GR Nor cannot be a Cepheid because the shape of the light curve is not stable. A search of the literature revealed that Lloyd Evans (1984) had previously drawn attention to the spectroscopic peculiarities of the variable, which suggest that it has characteristics of RS CVn variables.

Table 1

JD_{hel} 2450300+	V	B−V	V−I$_c$	JD_{hel} 2450300+	V	B−V	V−I$_c$
48.5571	12.677	1.193	1.466	62.5489	12.797	–	1.483
51.5472	12.693	1.218	1.474	63.5646	12.682	1.273	1.442
52.5659	12.744	1.217	1.473	79.5314	12.674	1.236	1.470
53.5198	12.691	–	1.464	80.5306	12.809	–	1.495
54.5314	12.736	1.240	1.471	81.5101	12.684	1.302	1.448
55.4986	12.648	1.238	1.446	82.5126	12.829	1.166	1.508
57.5729	12.681	1.230	1.460	83.5116	12.692	1.263	1.460
58.5404	12.738	1.269	1.448	85.5076	12.685	1.219	1.456
59.5306	12.671	1.243	1.441	86.5184	12.765	1.223	1.489
59.5668	12.682	1.229	1.461	87.5121	12.673	1.248	1.435
60.5384	12.788	1.236	1.481	88.5068	12.774	–	1.495
60.5654	12.829	1.328	1.443	89.5174	12.623	1.235	1.437
61.5469	12.703	1.243	1.468				

The research described here was made possible in part by grants No. 95–02–05276 from the Russian Foundation of Basic Research to LNB and through NSERC Canada to DGT. The authors were Visiting Astronomers at Cerro Tololo Inter-American Observatory, National Optical Astronomy Observatories, which is operated by the Association of Universities for Research in Astronomy, Inc. (AURA) under co-operative agreement with the National Science Foundation.

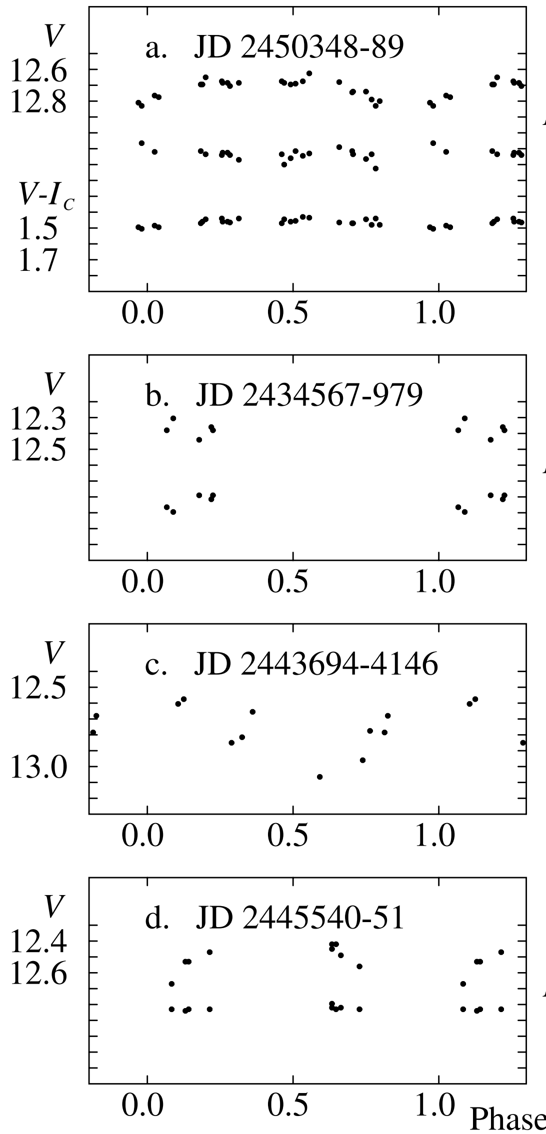

Figure 1

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NSV 02541, A DETACHED ECLIPSING BINARY STAR IN ORION

The variability of NSV 02541 (HD 290807, GSC 4767.0483, SVS 1007, CSV 000650) was first reported by Parenago (1946). In the NSV catalogue (Kholopov, 1982), this object is recorded as an eclipsing binary star without specifying type, with a photographic variation range from $11\overset{m}{.}1$ to $12\overset{m}{.}0$ and spectral type G5.

NSV 02541 was observed for 26 nights in the V band, from 9 October 1995 to 24 February 1996 from Mollet Observatory (Spain), using a CCD camera and a 0.4-m telescope. GSC 4767.1182 and GSC 4767.0335 were used, respectively, as comparison and check stars. To determine the magnitude and B−V color index of NSV 02541 and its comparison star, these objects were also observed in the B and V bands using a photoelectric photometer attached to the Cassegrain focus of the 0.6-m telescope at Esteve Duran Observatory. As comparison stars HR 1940, HR 1952, and HR 1955 were used.

Observations showed that NSV 02541 is, in fact, a detached eclipsing binary star with a period over 4.6 days (Figure 1). This object has a V magnitude of 10.64 ± 0.02 at maximum light. The amplitude, also in V, is $0\overset{m}{.}97\pm0\overset{m}{.}02$ for minimum I and $0\overset{m}{.}14\pm0\overset{m}{.}02$ for minimum II. Phase curve suggests that the primary minimum, with a duration of 21.5 $\pm$ 2 hours, is an annular transit. It also shows that minimum II is centered at phase 0.51, which indicates eccentric orbits for the components. Nevertheless, the long duration of eclipses and continuous bad weather conditions during the observation period did not allow to confirm these preliminary results.

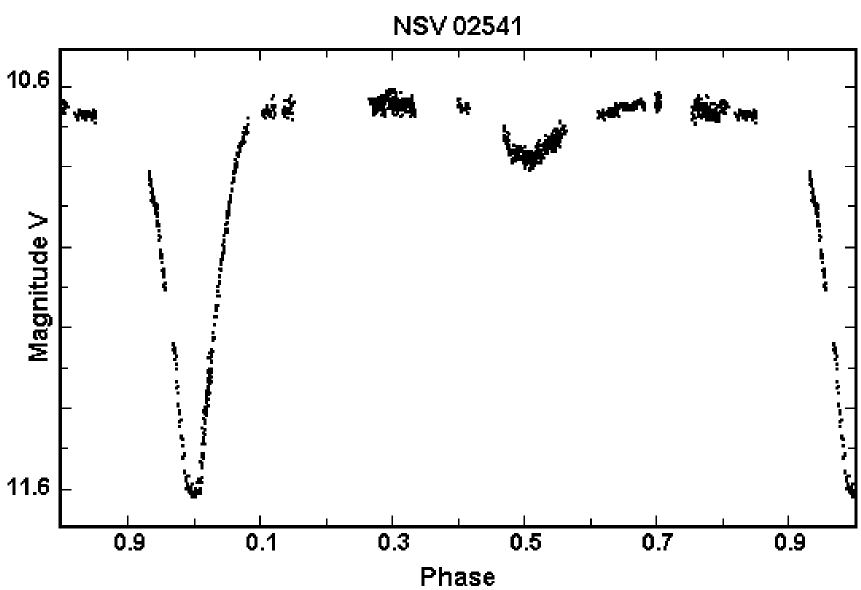

Figure 1

To check possible B−V color index variations, observations in the B and V bands were also performed for 6 nights, from October 1996 to January 1997, which sampled the light curve at the primary and secondary minima and at maximum light. These observations indicate that the B−V color index has a value of $0\overset{m}{.}87 \pm 0\overset{m}{.}03$, with no detectable variations beyond data scatter.

The following ephemeris was also derived:

$$\text{Min. I} = \text{HJD}\,2450073.5185 + 4\overset{d}{.}63404 \times E$$
$$\pm 0.0009 \quad \pm 0.00015$$

Although observations are not good enough to fit an accurate physical model for the binary system, they allowed to estimate the relative dimensions and luminosities of both components. These estimates indicate that the secondary star might be a K5 object of smaller size than the primary component. New spectroscopic and more photometric data are needed to clarify the exact nature of this system.

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NSV 00361 IS AN OVERCONTACT BINARY SYSTEM IN PISCES

NSV 00361 (HV 06379, CSV 000111, P 2493, GSC 0015.0112) was announced as a possible RR Lyrae type star by Shapley and Hughes (1934). According to Kholopov (1982) it varies from the 12.4 to 13.0 photographic magnitudes, without giving other data about its variability.

In order to have more information about this star, NSV 00361 was included in the program of the Grup d'Estudis Astronomics for the identification and characterization of new variable stars. The object was observed for 12 nights between 10 October 1996 and 2 December 1996 at Monegrillo Observatory (Spain). A CCD camera equipped with B and V filters was used attached to the 0.4-m telescope. BD+02°0139 (GSC 0015.0334) and GSC 0015.0231 were used as comparison and check stars respectively. To have an indication of its magnitude in the B and V bands, the comparison star was also observed with a photoelectric photometer coupled to the Cassegrain focus of the 0.6-m telescope at Esteve Duran Observatory.

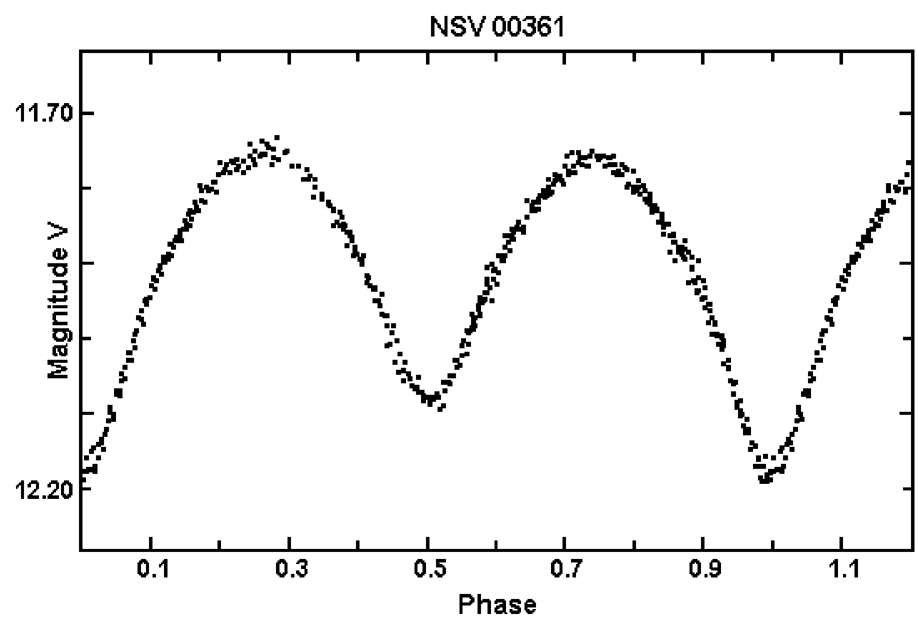

Figure 1

These observations allowed to determine that NSV 00361 is not an RR Lyrae but an overcontact eclipsing binary star with an amplitude of 0.43 ± 0.01 magnitudes at Min. I in the V band of ($0^m_.43 \pm 0^m_.02$ in B) and 0.33 ± 0.01 magnitudes at Min. II ($0^m_.33 \pm 0^m_.02$ in B). At maximum light, NSV 00361 is a 11.75 ± 0.08 magnitude object in the V band ($12^m_.68 \pm 0^m_.16$ in B). Figure 1 shows the phase curve of NSV 00361 in the V band.

The following ephemeris has been computed for the system:

$$\text{Min.I} = \text{HJD}\,2450376.43495 + 0\overset{\text{d}}{.}342487 \times \text{E}$$
$$\pm 0.00015 \quad \pm 0.000030$$

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Shapley, H., Hughes, E.M., 1934, *HA*, **90**, No. 4, 163

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NSV 08156, A POSSIBLE SEMIREGULAR VARIABLE IN HERCULES

NSV 08156 (BD+39°3076, CSV 007585, BV 0280, GSC 3072.1250) was announced as a variable star by Strohmeier and Knigge (1959), who indicated that it presented rapid variations between the 11.2 and 11.8 photographic magnitudes. Its spectrum is K0 and the Guide Star Catalog records this star with photovisual magnitude of 10.07 ± 0.40 (PAL-V1 filter).

The star was observed for 30 nights in the V band between 26 May and 1 December 1996 from Els Hostalets de Pierola Observatory (Spain), with a CCD camera attached to a 0.4-m telescope. Some observations with the 0.4-m Schmidt-Cassegrain telescope at Piera Observatory (Spain) were also carried out. As comparison star GSC 3072.1543 was used.

During the observation interval NSV 08156 varied with an amplitude of 0.78 magnitudes in V showing successive maxima and minima (Figure 1). An analysis of the data suggests that it could be a semiregular star with a cycle of about 42 days. Nevertheless, more observations are necessary to confirm this preliminary result.

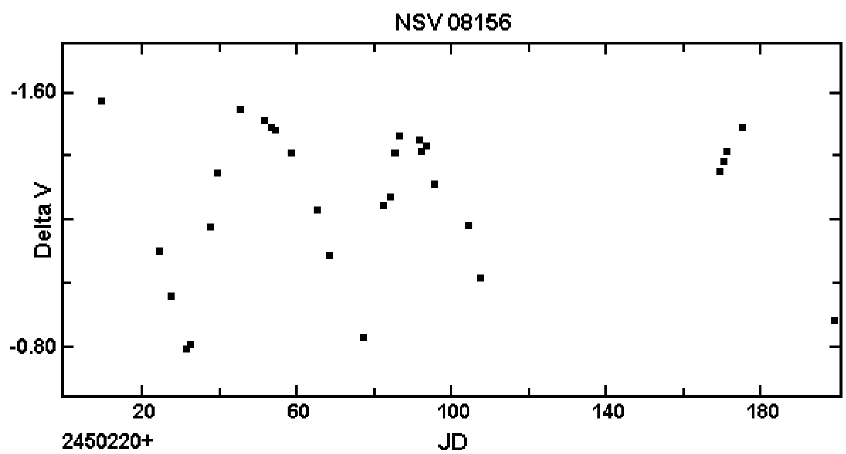

Figure 1

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Strohmeier, W., Knigge, R., 1959, *Bamberg Veröff.*, **5**, No. 4

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A NEW BETA LYRAE VARIABLE SAO 56342, AND TWO NEW POSSIBLE IRREGULAR STARS: BD+32°0599 AND SAO 56366

SAO 56342 (= HD 20511 = PPM 68334 = BD+32°0602 = AGK3+32°0318 = GSC 2345.1896) with a spectral type A0 is one of the variables discovered with the TYCHO instrument of the European satellite HIPPARCOS. Its light variation was announced by Makarov et al. (1994), indicating that its raw magnitude fluctuated between 7.90 and 8.33 without giving any further information.

From 3 November 1995, SAO 56342 was visually monitored by one of us to obtain more information about this object. These preliminary observations indicated that it might be a Beta Lyrae type eclipsing binary star with a period close to 1.47 days. This star was subsequently observed in the V band from 9 July 1996 to 1 December 1996 using a CCD camera, and a 6-cm finder telescope from Mollet del Valles Observatory and Esteve Duran Observatory (Spain). As comparison stars SAO 56376, SAO 56377, SAO 56355, and GSC 2345.1462 were used. Photometric observations were also performed using a photoelectric photometer attached to the Cassegrain focus of the 0.6-m telescope at Esteve Duran Observatory.

Our CCD observations show that SAO 56342 is a Beta Lyrae type eclipsing binary star. Its light curve (Figure 1), shows a conspicuous O'Connell effect (O'Connell, 1951) that amounts to Δm=Max. II–Max. I=0.03 magnitudes, where Max. II is the maximum following secondary minimum. According to photometric measurements, SAO 56342 is a 7.63 $\pm$ 0.02 magnitude object at Max. I. In addition, the star fades 0.41 magnitudes at primary minimum and 0.20 at secondary minimum. The following ephemeris was also computed:

$$\begin{array}{rl} \text{HJD Min. I} = & 2450401.594 + 1\overset{d}{.}46975 \times E \\ & \pm\ 0.001\quad \pm\ 0.00020 \end{array}$$

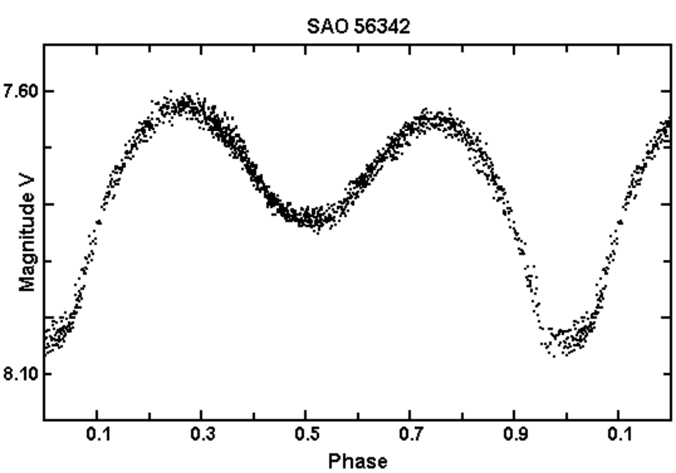

Figure 1

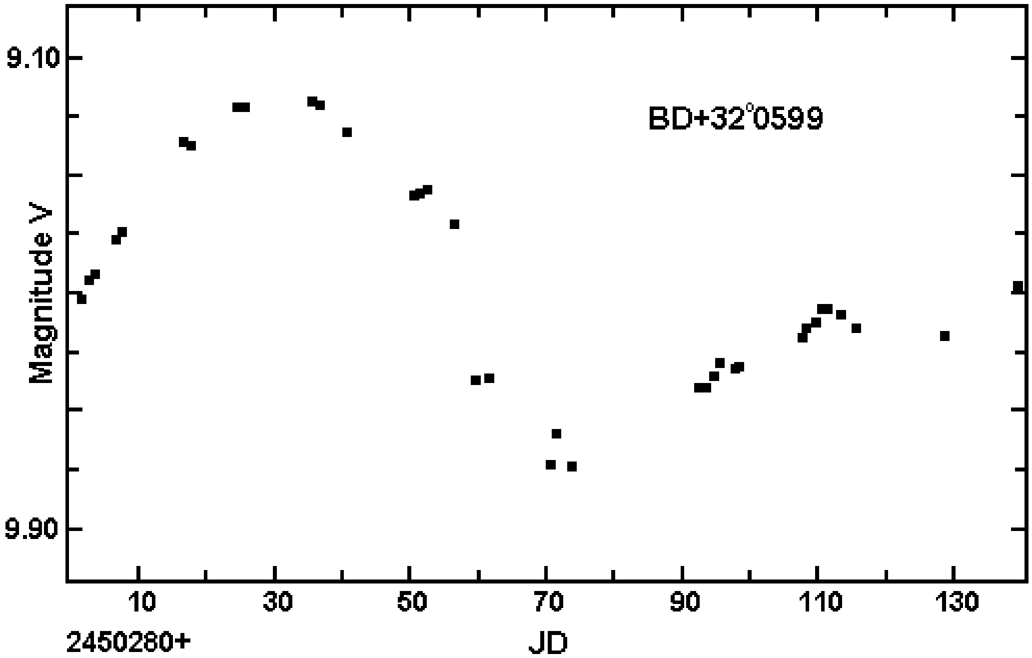

Figure 2

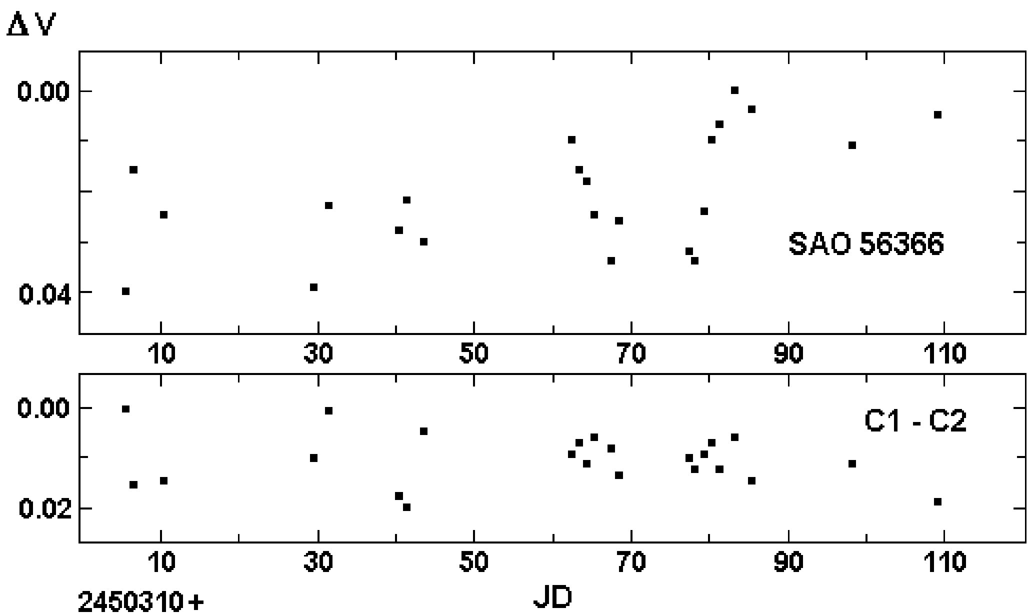

Figure 3

Photometric reductions also showed that the star BD+32°0599 (= PPM 68311 = AGK3+32°0315 = GSC 2345.1366) with a spectral type M8, is also variable. During the observation period BD+32°0599 underwent light changes in the V band between $9^{m}.2$ and $9^{m}.8$ (Figure 2). Its light curve indicates that it is probably irregular, although more photometric observations should be performed to ascertain its exact nature.

Furthermore, the star SAO 56366 (= HD 20678 = PPM 68634 = BD+32°0608 = AGK3+33°0316 = GSC 2345.1400) with a V magnitude of 7.9 and spectral type K0 was used as a check star. Photometric reduction suggests that this object is slightly variable with a maximum observed amplitude of 0.04 magnitude. Figure 3 depicts the mean magnitude of SAO 56366 for every night and also the mean magnitude of SAO 56376 (C1) with respect to SAO 56377 (C2). Variability of SAO 56366 is probably real and not due to differential color extinction: the comparison star SAO 56355 is also a K0 spectral type object but shows no detectable light variations beyond light curve scatter. However, more photometric observations should be performed to confirm the variability of SAO 56366.

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NSV 00821, A NEW OVERCONTACT ECLIPSING BINARY SYSTEM IN TRIANGULUM

NSV 00821 (= Wr 139 = CSV 005986 = GSC 2327.1518) was announced as a possible Cepheid by Weber (1963) with a photographic magnitude variation from $11^{m}_{.}8$ to $12^{m}_{.}5$ without giving any further information. To check it, the star was included in the program of the Grup d'Estudis Astronomics for observing poorly studied variables. An initial monitoring with the 0.4-m telescope at Mollet del Valles Observatory showed that NSV 00821 is not a Cepheid but an overcontact eclipsing binary system. It was then decided to follow this object with the 0.5-m telescope at L'Ametlla del Valles Observatory (Spain). NSV 00821 was observed for 21 nights between 27 September and 26 December 1996. GSC 2327.1604 and GSC 2327.1636 were used as comparison and check stars respectively. The Guide Star Catalog records GSC 2327.1518 (NSV 00821) with a photovisual magnitude of 11.48 ± 0.40 (PAL–V1 filter).

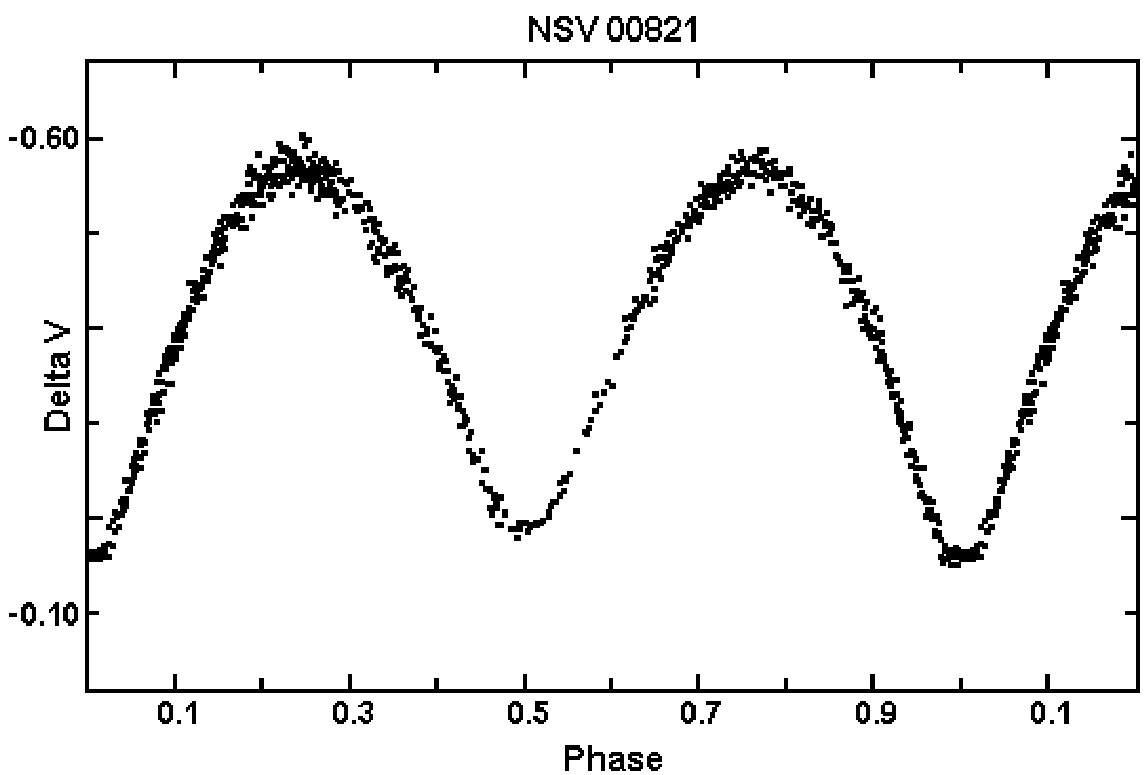

Figure 1

Observations obtained in the V band with a CCD camera, confirmed our preliminary data in the sense that NSV 00821 is an overcontact eclipsing binary system, with a period close to 16 hours 50 minutes (Figure 1). The amplitude of the light variation is 0.41 $\pm$0.01 magnitude at minimum I, which is a transit, and 0.39 $\pm$0.01 magnitude at minimum II, which is an occultation. The following ephemeris has been computed:

$$\begin{array}{ll} \mathrm{Min.\,I} = \mathrm{HJD}\,2450416.41635 & + \; 0\overset{d}{.}70170 \times \mathrm{E} \\ \phantom{\mathrm{Min.\,I} = \mathrm{HJD}\,245}\pm 0.00047 & \pm \; 0.00002 \end{array}$$

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Reference:
Weber, R., 1963, *IBVS*, No. 21

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ACTIVITY OF T CORONAE BOREALIS IN 1996

T CrB is one of best studied recurrent novae having undergone major eruptions in 1866 and 1946. At quiescence it is classified as a symbiotic binary with an M3 giant cool component (Kenyon 1986 and references therein). The most uncertain parameters of the system are the masses of both components. Most of the published orbital solutions (e.g. Kraft 1958; Kenyon & Garcia 1986) prefer the hot component less massive than the M3 giant but larger than the Chandrasekhar limit. This leads to models with rapidly increasing mass transfer onto a main sequence star as the reason of the nova-like outbursts (e.g. Webbink 1976; Cannizzo & Kenyon 1992). However, the UV data (e.g. Selvelli et al. 1992) and occasionally demonstrated flickering activity in the optical (see Dobrzycka et al. 1996 and references therein) are more easily interpreted if the giant has a white dwarf companion. Recently, Mikołajewski et al. (1996) suggested that T CrB may belong to the subclass (*propellers*) of symbiotic binaries in which a massive, magnetic and rapidly rotating white dwarf accretes matter from the M giant's wind.

Photoelectric observations were carried out using the one-channel UBVRI photometer with the 60cm telescope at Toruń observatory. The stars HD 143313 ($V = 8^{m}_{.}33; U - B = 0^{m}_{.}72; B - V = 1^{m}_{.}00; V - R = 0^{m}_{.}81; V - I = 1^{m}_{.}26$) and HD 142929 ($V = 8^{m}_{.}41; U - B = 0^{m}_{.}03; B - V = 0^{m}_{.}51; V - R = 0^{m}_{.}54; V - I = 0^{m}_{.}81$) were used as the comparison and the check, respectively. However, the first one seems to be a low-amplitude (less than $0^{m}_{.}05$) variable. UBVRI light curves covering more than one orbital period ($P = 227^{d}$) are shown in Figure 1. The occasional, one to three hours searches for rapid variability are marked in Figure 1 as filled triangles for positive detection or open ones for negative detection. During three nights we observed a flickering with amplitude $\sim 0^{m}_{.}4$ and $\sim 0^{m}_{.}2 - 0^{m}_{.}15$ in U and B, respectively. During the two remaining runs a possible amplitude was less than $0^{m}_{.}2$ in both filters. No flickering with an amplitude larger than $0^{m}_{.}1$ was observed in the VRI bands.

Spectral observations of the Hα region were carried out with a CCD-camera mounted in the coudé-spectrograph of the 2m telescope at NAO Rozhen. The resolution is 0.35 Å and the S/N ratio ~ 100 in the continuum around Hα. The epochs of observations are marked in Figure 1 and the profiles are shown in Figure 2.

Iijima (1990) noted that between dramatic nova-like outbursts T CrB exhibits two states: a "high" one when the emission lines (H I, He I) and the hot continuum are relatively strong, and a "low" one when they almost disappear. The last increase of Balmer emission lines as well as the He II 4686 appearance was noted by Iijima in April–July 1990 and over the five last years T CrB seems to remain in a low state. The Slovak photometric campaign (see Skopal et al. 1995 and references therein for previous reports) shows a very low level of U and B brightness and it excludes the presence of a blue continuum during this period. Anupama and Prabhu (1991) reported measurements of Hα equivalent widths that remain below 5-7Å after the "high" state in 1986-87, when they were larger than 20-30Å. Hα is also very weak in June 1989 (Ivison et al. 1994).

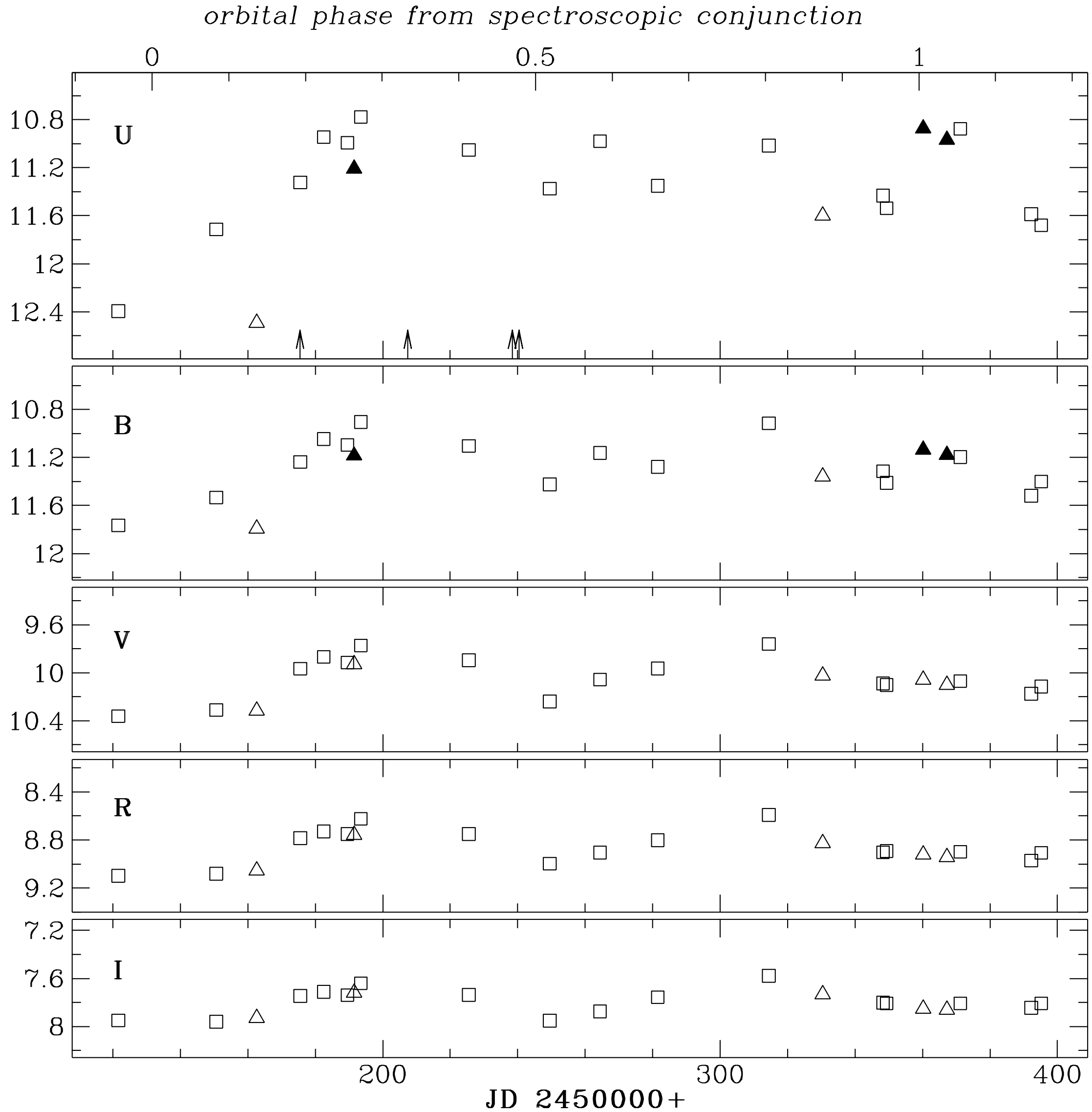

Figure 1: T CrB UBVRI light curves in 1996. Estimations derived from flickering runs are marked by *open* and *filled* triangles for negative and positive detection, respectively. The epochs of the Hα observations are marked by arrows in the U light box. The orbital phases from spectroscopic conjunction (M-giant in front) are taken from Kenyon & Garcia (1986)

In the beginning of April 1996 we observed a rapid increase in U light (Figure 1) by about $1\overset{m}{.}60$. Simultaneously, flickering variations with time scales from a few minutes to half an hour and amplitudes of about $0\overset{m}{.}5$ in U and $0\overset{m}{.}2$ in B appeared, whereas three weeks earlier they were not detected. Afterwards, the U magnitudes changed with an amplitude up to $0\overset{m}{.}8$ and time scale ~ 1.5 months, but until the end of our observations remained at least 1^{m} above the level of the "low" state in March 1996. The VRI light curves exhibit only the well known (e.g. Bailey 1975) ellipsoidal variations of the M giant with two distinct minima at spectroscopic conjunctions. The domination of the M giant in VRI is confirmed by the lack of flickering variations in these wavelengths. The B magnitudes in Figure 1 reflect both, the rotation of the M giant and the hot component activity.

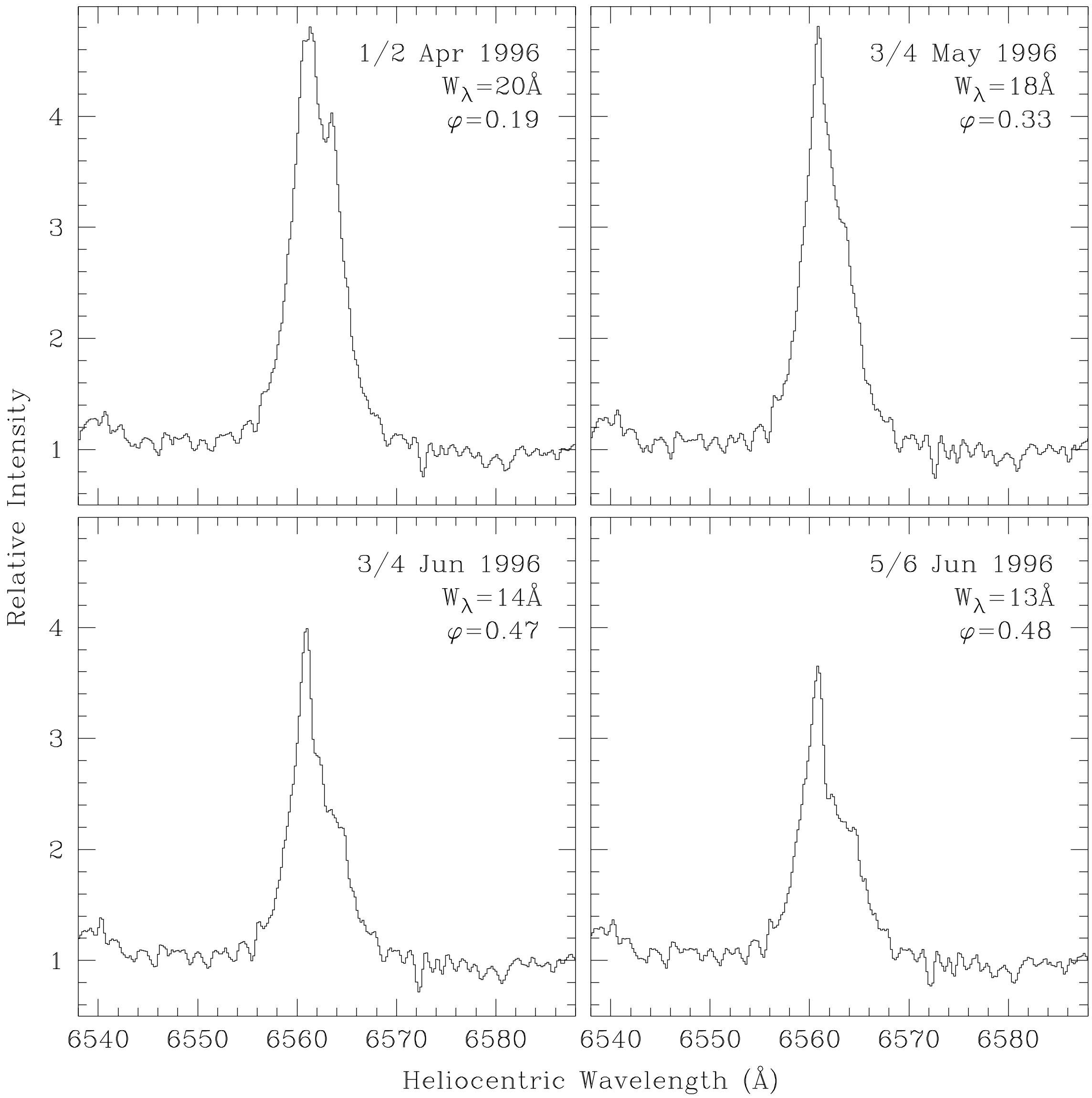

Figure 2: T CrB Hα profiles in 1996. The equivalent width and orbital phase are written in each box

Until now there is no observational evidence that T CrB is an eclipsing binary. Kenyon and Garcia (1986) mentioned that the ellipsoidal variations suggest a large orbital inclination and that several minima in the emission-line fluxes and the total UV flux occurred close to phase 0.0. Our data seemingly do not support this point of view. Just after phase 1.0 (Figure 1) the U magnitudes are close to the maximal value which we observed over the whole period and pronounced flickering variability is present as well. Nevertheless, between phases 0.8 and 1.0 a 1^{m} deep minimum is evidently visible in U light. Moreover, we did not detect flickering variations during this minimum. The minimum looks like an eclipse of the hot component by the M-giant which almost fills its Roche lobe. On the other hand, it is very similar to the previous two minima occurring typically for 1.5 months variability. Additionally, the spectroscopic conjunctions (phases 0.0, 0.5, 1.0 in Figure 1) and the minima caused by the ellipsoidal variations of the M-giant (VRI curves) are in good agreement. So, the minimum in U significantly precedes the spectroscopic conjunction in phase 1.0 and this cannot be interpreted as an eclipse.

Our spectral data (Figure 2) cover more than 25 per cent of the orbital period, but there are no indications that any emission component of Hα reflects the orbital motion. However, we tried to measure the radial velocity of each profile's "base", after cutting everything at the level 2.2 above the continuum. The Hα "base" velocity does not change significantly and remains about 20 km s^{-1} blueshifted relative to the γ-velocity. The lack of orbital motion in Hα suggests that the dimension of the region in which this emission originates can be comparable to the distance between stars and/or that $q = M_{cool}/M_{hot} < 1$. The large amplitude $K_{hot} = 33.5$ km s^{-1} obtained by Kraft (1958) from velocities of the Hβ emission on seven plates is probably casual. Any new observations, especially during the "high" activity phase, are very needed.

The equivalent width of Hα systematically decreases from 20Å to 13Å between April and June 1996. Similar values of the equivalent widths were observed by Anupama and Prabhu (1991) during the previous activity period in 1985-87. These authors also reported a very strange behaviour of Hα with pronounced peaks of intensity at both spectroscopic conjunctions. Our observations obtained a few days before orbital phase 0.5 do not show such behaviour and the mentioned effect can rather be an artefact.

Rising U and B brightness and Hα emission, as well as flickering activity denote that T CrB was in a "high" activity state in 1996.

Acknowledgments: We are much indebted to students of Toruń University, Karolina Darowny, Jakub Janowski, Maciej Wojtkowski and Paweł Reng for their assistance in carrying out photometric observations. This research was sponsored by the Polish KBN Grant No. 2 P304 007 06 and Bulgarian NFSR Grant No. F–574/1995.

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ERRATUM

In the original version Fig. 1. have been erroneously inserted in place of Fig. 2. too.

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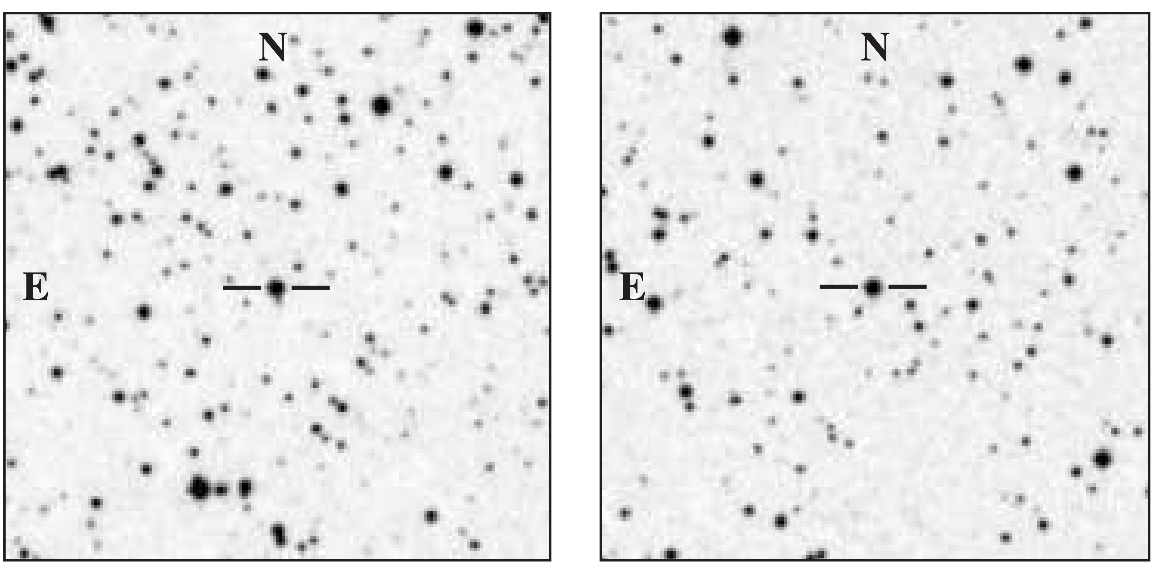
ACCURATE POSITIONS FOR 38 VARIABLES IN A $5^\circ\times5^\circ$ FIELD AROUND BL Lac

Photographs of the field around BL Lac were taken with the AFR-1 wide-field astrograph (D=23 cm, F=230 cm, $5\overset{\circ}{.}5\times5\overset{\circ}{.}5$ field) at Mt. Maidanak (Uzbekistan) in 1990–1992. The observations used the method described by Shokin (1991) which allows to attenuate brightness of bright reference stars. This reduces the influence of the brightness equation on positions of faint objects and makes it possible to determine their coordinates in a system very close to the fundamental one.

Positions of individual stars were derived from measurements of up to 15 plates. Table 1 contains equatorial coordinates, epochs of observations, and GSC numbers (Lasker et al., 1990) for 38 variable stars in a $5^\circ\times$ 5°field. The first column contains GCVS names or NSV catalog numbers. Asterisks mark stars whose positions are most accurate (better than to $0\overset{\prime\prime}{.}1$); for the majority of stars, the positions are accurate to $0\overset{\prime\prime}{.}1$-$0\overset{\prime\prime}{.}3$. For four stars (V665 Cyg, V666 Cyg, V668 Cyg, V672 Cyg), the derived positions are least accurate (to about $0\overset{\prime\prime}{.}3$) because we had to use three steps for reductions to the source catalog. The Palomar prints show V668 Cyg as two components, partially overlapping. The coordinates in Table 1 refer to the eastern, red component; its variability is evident from two Palomar O-prints.



GT Cyg **EL Lac**

Figure 1

Table 1

Star		$\alpha_{2000.0}$	$\delta_{2000.0}$	Epoch	GSC
UZ	Cyg	$21^h59^m14^s.314$	$+44°21'34''.58$	90.81	3197.0221
GT	Cyg	21 50 43.617	+42 54 11.52	90.81	3193.1551
MN	Cyg	21 58 01.526	+44 26 38.57	90.81	3197.1716
MU	Cyg	21 59 13.506	+44 42 00.43	90.81	3197.0616
V665	Cyg	21 49 15.956	+43 03 36.49	53.70	
V666	Cyg	21 49 25.862	+43 22 25.36	53.70	
V668	Cyg	21 49 56.837	+40 56 31.94	53.70	
V670	Cyg	21 50 19.432	+42 46 27.56	90.81	3193.0469
V672	Cyg	21 51 21.443	+44 39 50.12	75.30	
V673	Cyg*	21 51 37.755	+43 09 58.75	92.69	3197.2745
V676	Cyg	21 52 59.131	+44 18 19.25	90.81	
V677	Cyg	21 53 17.670	+44 03 23.08	90.81	3197.0163
V683	Cyg	21 57 32.615	+44 10 19.71	90.81	
V1093	Cyg	21 53 29.263	+44 05 05.35	90.81	3197.0545
V1096	Cyg*	21 55 52.164	+41 35 46.72	92.69	
RS	Lac	22 12 52.535	+43 45 01.03	90.81	3211.1056
RY	Lac	22 12 15.555	+43 50 04.23	90.81	3211.0260
BI	Lac	22 00 49.035	+42 45 39.25	90.81	3206.0669
BK	Lac*	22 02 19.725	+43 34 44.38	90.73	3210.1226
BL	Lac*	22 02 43.287	+42 16 39.92	90.73	
BO	Lac	22 14 56.692	+42 20 44.46	90.81	3207.0267
DE	Lac*	22 10 07.774	+40 55 10.63	90.73	3203.0565
DL	Lac	21 58 37.128	+41 46 24.61	90.81	3193.0554
EL	Lac	22 08 53.723	+42 16 21.26	90.81	3206.1935
ET	Lac*	21 59 06.287	+41 03 55.98	92.69	3189.0410
FU	Lac	22 00 26.741	+43 51 19.66	90.81	
GN	Lac	22 06 51.500	+43 22 57.20	90.81	3210.1444
KQ	Lac*	22 15 51.763	+40 25 13.08	92.69	3203.0344
V351	Lac*	22 00 48.151	+42 30 43.24	91.71	3206.0663
V352	Lac	22 01 11.566	+43 07 32.31	90.81	3210.1466
NSV 13904*		21 51 43.222	+43 09 23.62	92.69	
NSV 13917		21 52 39.266	+43 39 08.39	90.81	3197.1927
NSV 13922		21 52 58.166	+44 00 55.25	90.81	
NSV 13975		21 57 26.500	+42 58 18.65	90.81	
NSV 13976		21 57 29.886	+44 41 48.46	90.81	
NSV 13978		21 57 30.936	+43 20 56.83	90.81	
NSV 13989		21 59 00.750	+44 43 50.27	90.81	3197.0828
NSV 13990		21 59 23.863	+43 53 21.62	90.81	3197.0357

Table 2

Star	PPM	HIC
NSV 13907	062147	
NSV 13974	087224	
RT Lac	062368	108728
BG Lac	062336	108630
CM Lac	062327	
CS Lac	062318	
CX Lac	062506	
VZ Cyg	062131	107899

Table 2 contains PPM catalog (Röser and Bastian, 1991) identifications for eight bright variable stars in the program field; three of them are also identified with the HIPPARCOS input catalog (1992). We present finding charts (earlier never published) for GT Cyg and EL Lac; we have confirmed the variability of the corresponding stars using plates taken with the Sternberg Institute's 40 cm astrographs in Crimea. Each charts covers a $5' \times 5'$ field.

We are grateful to Mr. S. Antipin and Dr. V. Goranskij for assistance. This study was partially supported by the Russian Foundation for Basic Research through grant No. 95-02-05189. The finding charts are based on the Digitized Sky Survey, produced at the Space Telescope Science Institute under U.S. Government grant NAG W-2166.

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A SEARCH FOR γ DORADUS-TYPE VARIABLES IN THE OPEN CLUSTER M 34

The γ Doradus stars constitute a new class of low-amplitude variable stars. Krisciunas & Handler (1995) list known members and candidates. These stars typically show brightness variations of several hundredths of a magnitude on time scales of 0.5 to 3 days. γ Dor stars typically have early F-type spectra and are found on, or just above, the main sequence in the Hertzsprung-Russell Diagram. The most likely explanation for their variability is that they are exhibiting non-radial gravity mode pulsations (Aerts & Krisciunas 1996, Balona *et al.* 1996).

Eggen (1995) and Krisciunas *et al.* (1995) suggest that the γ Doradus phenomenon is age related. There is evidence that many of these stars are younger than 150 Myr. Krisciunas *et al.* (1995) searched for candidates in the Hyades (age $\approx$ 600 Myr) and found none. The basic idea is that once photospheric convection sets in, the gravity-mode pulsations no longer are observable. Given the masses of these stars (≈ 1.6 $M_\odot$), their main sequence phase must last about 3 Gyr. We are naturally interested to know what fraction of their main sequence life is spent exhibiting pulsations.

Our interest in M 34 (NGC 1039) is that it is a reasonably nearby open cluster whose age is estimated to be 250 Myr (Ianna & Schlemmer 1993), which is in between the age of NGC 2516 (with eight γ Dor stars) and that of the Hyades. Ianna & Schlemmer (1993) provide a finding chart, plates coordinates, apparent magnitudes and B–V colors for the stars. Their photometry, however, is derived from photographic plates and is accurate to no better than $\approx$ 0.1 mag.

Given that early F stars listed in the *Bright Star Catalogue* have B–V colors in the range 0.26 to 0.40, and given the color excesses of the stars in M 34 (0.07 mag), we selected stars from Ianna and Schlemmer's list with $0.33 < B–V < 0.47$. With one exception (UVa 197) all of our 11 program stars have membership probabilities greater than 0.6. We used UVa 123 as our principal comparison star and UVa 166 as a check star. These two stars and 9 of our 11 program stars were observed photoelectrically by Johnson (1954). Our observing procedure was to do V-band differential photometry and observe the principal comparison star after every third program star. Transformation to the UBV system was accomplished with differential measures of the red-blue pair BS 8451 and BS 8453 (Hall 1983).

We observed at Mauna Kea with the University of Hawaii's 0.6-m telescope and an Optec SSP-5 photometer belonging to the University of Hawaii at Hilo. Our seven night run began on 19 September 1996 UT. We lost three whole nights to clouds and one to equipment problems but did manage to obtain some accurate photometry. From observations of the principal check star (UVa 166) and 5 of our program stars that appeared to be constant (UVa 135, 186, 197, 200, and 251) we estimate that the accuracy of an individual measurement was $\pm$ 5.5 mmag. (Our faintest star, UVa 236, gave a lower signal to noise ratio and a correspondingly larger internal error.)

Table 1. Summary of differential photometry of M 34 stars. The comparison star in all cases was UVa 123 (V = 10.46, B–V = 0.16). For each star we give the assigned UVa numbers of Ianna & Schlemmer (1993), the mean differential V magnitude, the internal error of a single differential value (i.e. the standard deviation of the distribution, *not* the mean error of the mean), and the number of data points

UVa	$< \Delta V >$	σ(mmag)	N
135	0.780	5.7	20
144	1.017	10.0	21
161	1.442	5.8	19
162	1.003	5.9	19
166	−0.749	4.7	21
186	0.722	3.9	19
197	0.639	5.1	18
200	1.008	6.9	18
224	1.035	11.4	18
232	0.995	7.3	19
236	2.406	16.1	18
251	1.238	7.1	18

Our individual data, amounting to 228 differential measurements, can be obtained from IAU Commission 27 as file 318E of unpublished photometry. (See Breger, Jaschek, & Dubois 1990 for further information on that archive.) We give in Table 1 a summary of the photometry obtained. The internal error of our nightly means in Table 1 compared to the differential magnitudes derivable from Table 5 of Ianna & Schlemmer (1993) is ± 0.082 mag, which we attribute to the fact that their data were derived from photographic plates. It is also revealed that the V magnitude adopted by Ianna & Schlemmer is systematically too bright. If we use as a reference the V-band values for the 10 stars observed photoelectrically by Johnson (1954), the mean internal error is ± 0.021 mag. One should adopt Johnson's value of V = 10.46 for the comparison star, UVa 123.

Because the differential magnitudes of our check star, UVa 166, and five of our program stars were constant, we have great confidence that our comparison star, UVa 123, is constant. Therefore, any variations observed in the other program stars can be attributed to those stars. Six of our eleven program stars showed evidence of low-amplitude variability and are deserving of further study. UVa 144, 224, 232, and 236 showed evidence of differing nightly means, while UVa 161, 162, 224, and 232 showed some evidence for variations over the course of a single night. While we do not yet have data sufficient to prove that any of these stars are *bona fide* γ Doradus-type variables (one would want enough to obtain a decent power spectrum), we show below the light curve of the best γ Dor candidate in M 34, UVa 224. It is reminiscent of parts of other single-site light curves of γ Dor stars. See for example Mantegazza, Poretti, & Zerbi (1994).

If it is confirmed that one or more of the early F stars in M 34 vary by several hundredths of a magnitude on a time scale of 0.5 to 3 days, we will then know for certain that the γ Doradus phenomenon extends to an age of 250 Myr in the lives of main sequence stars of mass ≈ 1.6 $M_\odot$.

Acknowledgments: We thank Ted Simon for drawing our attention to M 34. We thank Susanna Martin for useful discussions and for her (clouded out) attempts to observe these same stars. KK thanks the University of Hawaii for time on the 0.6-m telescope, and thanks the Joint Astronomy Centre for observing support.

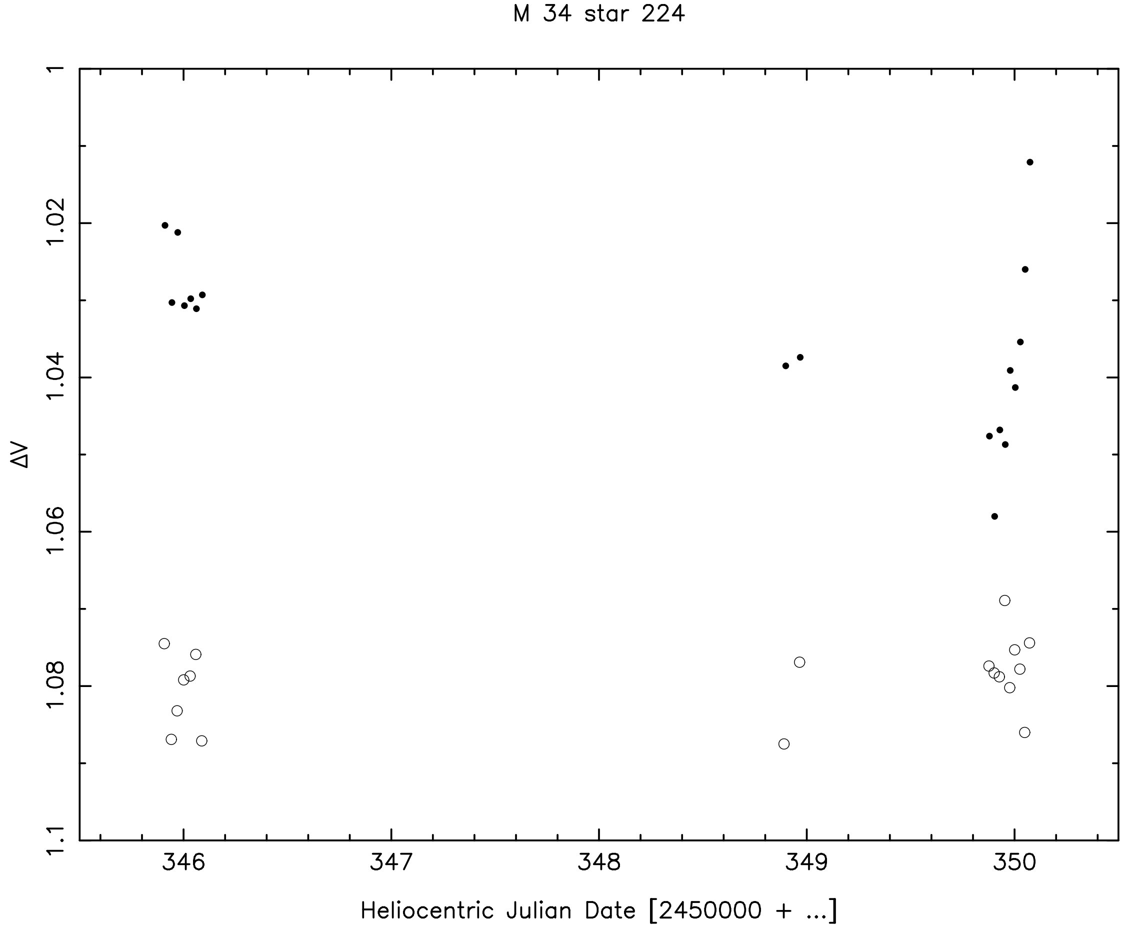

Figure 1. Differential V–band photometry of UVa 224 vs. UVa 123 (dots). Data for the star UVa 197 vs. UVa 123 (open circles) are also shown, offset by an arbitrary amount

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IDENTIFICATION OF THE MARGONI–STAGNI VARIABLES

In a 1984 publication, "A search for new variable stars in the Milky Way field at $l = 78°$, $b = -6°$", R. Margoni and R. Stagni give finding charts, light curves, and elements for 99 new variable stars. A follow-up paper (Margoni et al. 1989) contains additional observations for the same stars. About three-quarters of these are now named variables. I have gone through this list to determine precise positions for all the stars, and have made identifications with the IRAS and GSC catalogues. Positions were drawn mostly from the GSC (version 1.1), or the U.S. Naval Observatory UJ1.0 and A0.9 catalogues (Monet et al. 1994, Monet 1996). The deep USNO catalogues were of considerable value in obtaining positions for the fainter stars. Where a star does not appear in any of these, I have used the Goddard SkyView facility (Scollick 1997) to estimate positions accurate to about $\pm 2''$ from the digitized sky survey (DSS) with a coordinate-grid overlay.

The table is largely self-explanatory. The source of each position is indicated in the column 's' immediately following, using the following codes:

A = A0.9
G = GSC
U = UJ1.0
S = SkyView
P = PPM (one star only)

Stars 56 and 85 have positions from the literature as noted in the remarks, which I have verified by comparing the Margoni–Stagni charts against the DSS.

The principal variable-star names are given in the 'Other IDs' column, along with names found in SIMBAD. Notes on specific stars are indicated by an asterisk in column 'n', and follow after the end of the table.

Table 1. The Margoni–Stagni Variables

[MS84]	RA (2000)	Dec	s	IRAS	GSC	n	Other IDs
1	20 39 31.0	+35 53 17	A	20375+3532			
2	20 40 17.3	+35 59 06	U	20383+3548			V1828 Cyg
3	20 41 19.0	+34 44 52	U			*	Hen 2-468
4	20 41 45.7	+35 01 45	U				
5	20 42 15.5	+35 33 34	S	20402+3522			V1831 Cyg
6	20 42 11.9	+35 52 17	S	20402+3541			V1830 Cyg
7	20 42 15.7	+35 58 29	S	20403+3547			V1833 Cyg
8	20 43 00.0	+35 29 48	G		2695-1133	*	LHS 3574
9	20 43 06.0	+34 13 40	U				
10	20 43 12.6	+35 42 51	S	20412+3531			V1834 Cyg
11	20 43 50.5	+34 28 49	G	20418+3417	2695-1838		V1975 Cyg
12	20 44 15.1	+37 05 32	A				
13	20 44 34.2	+34 36 21	U				V1835 Cyg
14	20 44 42.9	+35 58 19	G	20427+3547	2699-2314		V1836 Cyg

Table 1 (cont.)

[MS84]	RA (2000)	Dec	s	IRAS	GSC	n	Other IDs
15	20 44 53.9	+36 43 16	G	20429+3632	2699-1398		
16	20 45 10.9	+36 48 41	G	20432+3637	2699-1805		
17	20 45 25.9	+37 45 32	S	20435+3734	3166-1680	*	V1837 Cyg
18	20 45 41.6	+36 44 12	U	20437+3633			V1838 Cyg = EM* VES 238
19	20 45 44.8	+35 43 52	U				V1839 Cyg
20	20 45 46.6	+33 48 47	U	20437+3337			V1840 Cyg
21	20 45 51.8	+36 06 39	A	20438+3555		*	V1841 Cyg
22	20 45 51.2	+36 59 46	G		2699-1426		
23	20 46 07.1	+36 56 53	G	20441+3645	2699-2963		V1842 Cyg = CGCS 4967
24	20 46 27.7	+34 03 53	S				V1843 Cyg
25	20 46 36.2	+36 45 31	A				V1844 Cyg
26	20 46 43.2	+34 29 49	U	20447+3418			V1845 Cyg
27	20 47 19.0	+36 14 01	U		2699-2644	*	V1847 Cyg
28	20 47 18.5	+36 23 29	U	20453+3612			V1846 Cyg
29	20 47 22.5	+36 39 47	U				not GSC 2699-0693
30	20 47 28.7	+36 16 57	S				V1848 Cyg; not HD 198196
31	20 47 43.4	+34 19 04	G	20457+3408	2695-3678		V1976 Cyg
32	20 47 47.4	+36 14 49	S	20458+3603			V1849 Cyg = CGCS 4976
33	20 47 56.6	+35 44 20	S		2699-3236	*	V1850 Cyg
34	20 48 08.0	+35 01 10	U	20461+3450			V1851 Cyg
35	20 48 11.3	+36 09 17	G		2699-2555		
36	20 48 13.5	+36 14 55	U				
37	20 48 13.9	+36 14 25	U				V1852 Cyg
38	20 48 14.2	+36 52 36	G	20463+3641	2699-1038		V1854 Cyg = EM* VES 245
39	20 48 21.5	+33 54 33	S	20463+3343		*	V1855 Cyg
40	20 48 19.4	+35 27 34	G		2695-0975		V1856 Cyg
41	20 48 27.0	+34 13 15	S	20464+3402			V1857 Cyg
42	20 48 25.3	+37 45 31	G	20465+3734	3166-1801		
43	20 48 30.2	+36 13 47	A				V1858 Cyg
44	20 48 34.4	+36 44 56	A			*	
45	20 48 55.6	+33 23 19	G	20469+3312	2691-2274		V1978 Cyg
46	20 48 55.3	+36 09 44	A	20470+3559			V1859 Cyg
47	20 49 04.4	+34 16 11	G	20471+3405	2695-2300		V1860 Cyg
48	20 49 05.5	+37 27 30	U	20471+3716			V1861 Cyg
49	20 49 16.2	+33 13 47	U	20472+3302	2691-2538	*	V1862 Cyg
50	20 49 17.1	+33 13 33	P		2691-2536		AG+33° 2010
51	20 49 38.4	+37 12 48	G	20477+3701	2699-0835		V1863 Cyg
52	20 50 02.0	+34 46 44	A				
53	20 50 05.0	+37 30 00	U	20481+3718			V1864 Cyg = LD 31

Table 1 (cont.)

[MS84]	RA (2000)	Dec	s	IRAS	GSC	n	Other IDs
54	20 50 14.3	+33 53 26	U				
55	20 50 15.0	+34 10 50	G	20482+3359	2695-3508		DO 19513 = IRC +30457
56	20 50 18.1	+33 36 33	*	20482+3325		*	[PCC93] 430
57	20 50 19.2	+34 37 54	S	20483+3426		*	V1865 Cyg
58	20 50 16.4	+37 56 45	G		3167-1279		
59	20 50 36.9	+36 18 43	U				V1866 Cyg
60	20 50 40.3	+35 25 37	S				V1867 Cyg
61	20 50 51.4	+33 41 42	U				V1979 Cyg
62	20 51 17.0	+34 31 04	U				
63	20 51 14.4	+36 53 32	G	20493+3642	2700-0028		V1868 Cyg
64	20 51 39.3	+33 27 24	U			*	V1869 Cyg
65	20 51 33.7	+36 57 03	A	20496+3645			
66	20 51 40.6	+35 17 32	G	20496+3506	2696-3010		V1871 Cyg
67	20 51 41.1	+35 44 08	G		2700-1545		V1870 Cyg
68	20 51 45.0	+33 07 57	U	20497+3256			V1872 Cyg
69	20 52 02.8	+36 07 58	U	20500+3556			V1873 Cyg
70	20 52 04.8	+35 59 10	S		2700-0349	*	V1874 Cyg
71	20 52 07.5	+35 58 30	G		2700-1559	*	V1875 Cyg
72	20 52 27.5	+36 54 36	S	20505+3643		*	V1876 Cyg
73	20 52 43.4	+34 24 10	G		2696-3393		V1877 Cyg
74	20 53 00.7	+38 11 15	U				V1878 Cyg
75	20 53 15.2	+32 53 00	S			*	
76	20 53 50.0	+37 15 34	S				V1879 Cyg
77	20 54 04.4	+35 54 45	U	20521+3543			V1880 Cyg
78	20 54 44.2	+34 37 48	U	20527+3426			V1881 Cyg
79	20 55 19.6	+37 46 50	U				V1882 Cyg
80	20 55 55.3	+36 01 13	A				V1883 Cyg
81	20 56 07.1	+33 39 07	U				V1884 Cyg
82	20 56 14.0	+34 40 48	S	20542+3429			V1885 Cyg
83	20 56 13.6	+36 21 52	G	20542+3610	2700-2803		V1886 Cyg
84	20 56 41.5	+33 09 36	U				V1887 Cyg
85	20 56 53.4	+37 25 12	*			*	V1888 Cyg
86	20 57 10.3	+34 08 09	G	20551+3356	2696-1758		V1889 Cyg
87	20 57 21.6	+37 55 20	S			*	
88	20 57 46.9	+35 58 03	G		2700-0475	*	V1890 Cyg
89	20 57 50.0	+34 09 51	U				
90	20 59 21.1	+34 41 05	A				V1892 Cyg
91	20 59 28.0	+36 39 03	U				
92	20 59 42.3	+34 01 46	U				
93	20 59 50.0	+34 20 07	A				V1893 Cyg
94	21 00 34.5	+37 29 36	U				
95	21 00 45.1	+34 05 07	G	20587+3353	2709-1744		V1894 Cyg
96	21 00 48.4	+36 32 09	U				V1895 Cyg
97	21 01 19.8	+36 25 54	A				V1896 Cyg

Table 1 (cont.)

[MS84]	RA (2000)	Dec	s	IRAS	GSC	n	Other IDs
98	21 02 29.2	+35 09 59	A	21004+3457			V1897 Cyg
99	21 05 05.0	+35 40 02	G		2713-0126		V1900 Cyg

Notes

3 symbiotic star (Carrasco et al. 1983).

8 G 210-31 position corrected for annual proper motion of $-0''.225/-0''.575$.

17 the southeastern star of a close pair.

21 Margoni–Stagni chart slightly in error; northwestern star of a close pair.

27 the northwestern star of a close pair.

33 the northern star of a close pair.

39 position is for the northern/brighter of two stars.

44 the southern/fainter of two stars.

49 BD+32°3954 = IRC +30456. The PPM assigns the BD name in error to the visually fainter companion southwest at end-figures $15^{s}.2/42''$.

56 VLA position from Lewis et al. (1990).

57 not GSC 2695-2517.

64 not NSV 13365, which is at: 20 51 48.6 +33 28 04 (U).

70 western star of a merged pair.

71 eastern of two stars.

72 crowded: position somewhat uncertain.

75 on northwest side of GSC 2692-2430.

85 AFGL 2679 position from Joyce et al. (1977).

87 the southeastern of two stars.

88 northeastern of two stars.

I appreciate the help of William P. Bidelman in reviewing this list for errors and identifications. This work was greatly facilitated by the use of SIMBAD, maintained by the Centre de Données Astronomiques, Strasbourg, France; SkyView, maintained by Keith Scollick at Goddard Space Flight Center; and the wonderful U. S. Naval Observatory PMM catalogues, which were prepared by Dave Monet and colleagues at USNO-Flagstaff.

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NSV 4539 IS AN ECLIPSING BINARY

[BAV Mitteilungen Nr. 96]

NSV 4539 (= GSC 238.0737 = PPM 155983 = SAO 117785 = BD +05°2200 = HD 082908 (A2) = CSV 101063 = 349.1934 = Pr 3303 = AG +04°1322) was announced as a short period variable by Hoffmeister (1934) with a brightness range between 9^m and 10^m and a spectral type A2. Sandig (1947) found NSV 4539 (= Pr 3303) to be constant at $9\overset{m}{.}5$ on 35 photographic plates. According to Tsesevich (1952) NSV 4539 is probably not periodic and in no case short periodic.

Because of their proximity, NSV 4539 was included in a photometric investigation of AV Hya. Every third day, NSV 4539 showed an ascending branch from a minimum. Our photoelectric measurements on 20 nights in 1995 and 1996 excluded that the period is an integer fraction of these 3 days.

The photoelectric observations were made at the private observatory of one of us (F.A.) with an automatic photoelectric telescope. The photometer was equipped with an uncooled EMI 9781A tube and Schott filters for B and V. The moment of minimum light of completely observed minima was calculated using the method of Kwee and van Woerden (1956), for the others, the minima times were derived from the descending or ascending branches.

SAO 117771 (F8) served as comparison star and SAO 117803 (F5) was used to check its constancy. The amplitude of the primary minimum is about $0\overset{m}{.}40$. In the secondary minimum the amplitude does not exceed $0\overset{m}{.}05$ in V and is even less in B. The duration between first and last contact is about 8.5 hours; a total eclipse could not be detected. The individual measurements are sent by e-mail on request.

The construction of a complete lightcurve was found to be extremely difficult from one location, for the difference between the period and three whole days sums up to almost a whole day after a year. The photoelectric lightcurve is therefore incomplete. To get information about period changes in the past and of those parts of the lightcurve which could not be observed, one of us (T.B.) investigated the star on 635 plates of the Sonneberg Sky Survey covering the interval from 1956 until 1995. Photographic magnitudes were obtained with a photometer and refer to Harvard-Groningen SA 100 (see Figure 1). The following comparison stars were used:

GSC 238_1193	8.48 m_{pg}
GSC 238_1621	9.03 m_{pg}
GSC 238_1847	9.49 m_{pg}

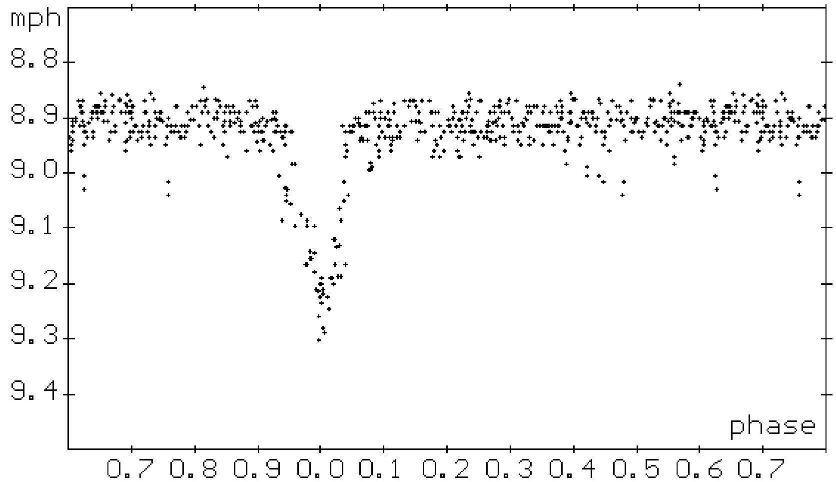

Figure 1. Differential photographic light curve of NSV 4539, drawn with the ephemeris (2) derived in this paper

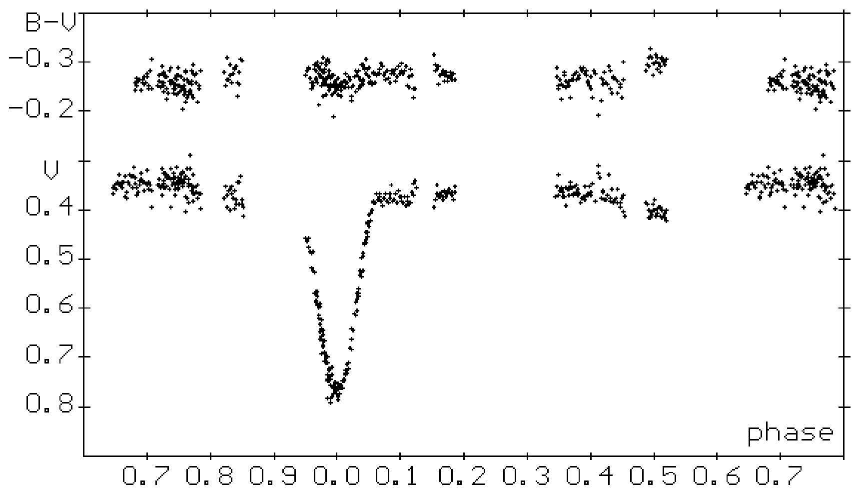

Figure 2: Differential photoelectric light curve in V and B − V of NSV 4539, drawn with the ephemeris (2) derived in this paper

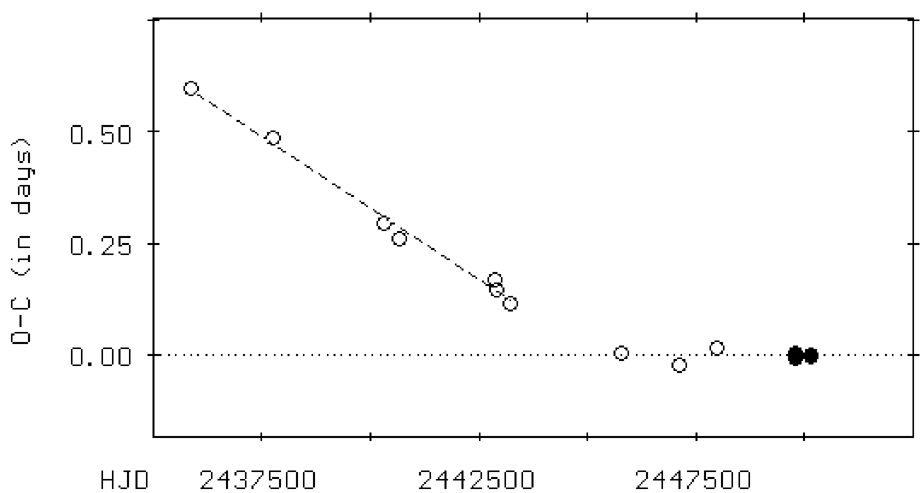

Figure 3: O–C diagram of NSV 4539, drawn with the ephemeris (2) derived in this paper

Obviously the period has not been constant in the examined interval. Weighted least squares fits provided the following set of linear ephemeris:

From JD 2435848 to JD 2444702:

$$\mathrm{Min\,I} = \mathrm{HJD}\,\underset{\pm 26}{2437752.353} + \underset{\pm 78}{3\overset{\mathrm{d}}{.}0093968} \times \mathrm{E} \qquad (1)$$

From JD 2444984 to JD 2450151:

$$\mathrm{Min\,I} = \mathrm{HJD}\,\underset{\pm 6}{2450151.3916} + \underset{\pm 25}{3\overset{\mathrm{d}}{.}0095905} \times \mathrm{E} \qquad (2)$$

Until now, it has been not possible to decide whether the period changes occur in an erratic, periodic or secular way. Further observations are needed.

Table 1. Times of minima for NSV 4539, epochs and residuals computed with respect to the ephemeris (2)

N	JD hel.	W	T*	Epoch	O−C	Observer
1	2435874.492	1	P	−4744.0	+0.598	Berthold
2	37752.366	1	P	−4120.0	+0.487	”
3	40325.375	1	P	−3265.0	+0.296	”
4	40656.396	1	P	−3155.0	+0.262	”
5	42871.362	1	P	−2419.0	+0.170	”
6	42889.396	1	P	−2413.0	+0.146	”
7	43217.411	1	P	−2304.0	+0.116	”
8	45763.413	1	P	−1458.0	+0.004	”
9	47099.643	1	P	−1014.0	−0.024	”
10	47969.456	1	P	−725.0	+0.018	”
11	49778.203	10	V	−124.0	+0.001	Agerer
12	49778.205	10	B	−124.0	+0.003	”
13	49784.221	10	V	−122.0	−0.001	”
14	49784.226	10	B	−122.0	+0.004	”
15	49787.233	10	B	−121.0	+0.002	”
16	49787.234	10	V	−121.0	+0.003	”
17	49793.242	5	V:	−119.0	−0.008	”
18	49793.243	5	B:	−119.0	−0.007	”
19	50142.360	5	V:	−3.0	−0.003	”
20	50151.3886	10	V	0.0	−0.0030	”
21	50151.3921	10	B	0.0	+0.0005	”

* P denotes photographic minima, B and V are photoelectrically observed, those marked ‘:’ got reduced weight (W).

We want to acknowledge the help by the management and staff of Sonneberg Observatory.

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IDENTIFICATION OF THE ROSINO–GUZZI VARIABLES IN SAGITTA

The list below gives accurate coordinates and IRAS identifications for all but one of the 123 red variable stars found by Rosino & Guzzi (1978) on a series of infrared plates. These faint stars lie in very crowded Milky Way fields. To determine accurate positions, each star was examined on the digitized sky survey using the Goddard SkyView facility (Scollick 1997). The IRAS identifications were found using SIMBAD. A few of the stars were bright enough to appear in the GSC or the USNO UJ1.0 and A1.0 catalogues (Monet et al. 1994, Monet 1996); these positions were adopted when available.

The finder chart for the star numbered 67 (MX Sge) does not match the sky at the position given by Rosino & Guzzi. I searched at the positions of nearby IRAS sources, and at various obvious places where a typo might be involved ($\pm1^\circ$, $1^{\rm m}$, $10'$, etc.), all to no avail. MX Sge must be considered lost for now. The position for star 107 (PP Sge) was given in error by $+1^\circ$ in Dec, and is corrected below.

The table lists equinox 2000 positions, the source of the position (A = A1.0, G = GSC version 1.1, S = SkyView, U = UJ1.0), IRAS names, spectral types from the source paper (they are for the time of maximum), and variable-star designations from the GCVS4 (Kholopov et al. 1985). The final column contains additional remarks; an asterisk indicates a note at the bottom of the table.

I appreciate the efforts of Gérard Jasniewicz (l'Observatoire de Strasbourg) to integrate these stars into the SIMBAD database.

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Scollick, K. 1997, http://skview.gsfc.nasa.gov/cgi-bin/v3.0/skyview_advanced

Table 1: The Rosino–Guzzi Variables

[RG78]	RA (2000)	Dec	s	IRAS	spec	GCVS4	Remarks
1	19 06 14.1	+18 52 01	A	19040+1847		HV Sge	
2	19 06 56.7	+18 20 17	A		M5	HW Sge	
3	19 07 16.2	+18 17 50	A	19050+1813	M8	HX Sge	
4	19 07 26.8	+17 56 30	U	19052+1751	M5	HY Sge	
5	19 07 30.8	+18 17 33	S	19053+1812	M7:	HZ Sge	
6	19 08 11.2	+17 54 54	G		M4	II Sge	GSC 1590-2950
7	19 08 42.0	+18 42 20	S	19064+1837	M7	IK Sge	*
8	19 08 46.1	+18 27 07	A	19065+1822		IM Sge	
9	19 09 06.2	+18 38 00	S	19069+1833	M6	IN Sge	
10	19 09 52.5	+17 39 51	A	19076+1734		IO Sge	*
11	19 09 54.8	+17 20 28	A		M3	IP Sge	
12	19 10 20.6	+17 40 29	S	19081+1735	M2	IR Sge	*
13	19 10 21.2	+17 13 05	S		M6	IQ Sge	
14	19 10 35.8	+17 30 41	A	19083+1725		IS Sge	
15	19 10 40.9	+17 13 00	S			IT Sge	
16	19 10 43.5	+18 56 49	S	19085+1857	M7	IU Sge	
17	19 10 46.4	+19 57 09	A	19085+1952	M10	IV Sge	
18	19 10 57.3	+17 42 04	S	19087+1737	M7	IW Sge	*
19	19 10 57.0	+18 34 34	S		M8	IX Sge	
20	19 11 03.1	+17 20 33	S		M8	IY Sge	crowded
21	19 11 11.5	+18 48 12	G	19089+1843	M9	IZ Sge	GSC 1594-0513
22	19 11 16.8	+17 51 52	G	19090+1746	M7	KK Sge	GSC 1590-3155
23	19 11 33.4	+18 36 14	S	19093+1831	M7	KM Sge	
24	19 11 36.3	+16 45 43	S	19093+1640		KL Sge	
25	19 11 38.7	+20 13 21	A		M4	KN Sge	
26	19 11 39.7	+20 03 02	A	19094+1957	M3	KO Sge	
27	19 11 54.2	+17 18 40	A		M6	KP Sge	
28	19 12 00.0	+16 42 08	A	19097+1637	M5	KQ Sge	
29	19 12 28.6	+19 17 22	A	19102+1912		KR Sge	
30	19 12 37.2	+16 53 53	S		M2	KS Sge	
31	19 12 54.7	+16 39 57	S	19106+1634	M8	KT Sge	
32	19 12 57.9	+17 36 02	S	19107+1730	M3	KU Sge	
33	19 12 59.0	+20 25 30	A			KV Sge	
34	19 13 26.1	+18 26 54	S	19112+1821	M4	KW Sge	
35	19 13 46.6	+17 52 24	S		M5	KX Sge	
36	19 13 47.8	+17 38 55	S		M6	KY Sge	*
37	19 13 55.6	+19 09 04	S	19117+1903		KZ Sge	*
38	19 14 26.3	+19 20 10	S	19122+1914	M8	LL Sge	
39	19 14 31.6	+19 31 30	S		M6	LM Sge	
40	19 14 38.9	+17 35 19	A			LN Sge	*
41	19 14 42.7	+16 19 13	S	19124+1613		V1347 Aql	
42	19 14 43.8	+17 18 04	S	19124+1712	M4	LO Sge	
43	19 14 43.8	+17 55 04	S		M8	LP Sge	
44	19 14 52.6	+20 36 49	S	19127+2031		LQ Sge	
45	19 15 00.7	+20 01 05	S	19128+1955	M4	LR Sge	
46	19 15 02.8	+19 30 57	S		M8	LS Sge	
47	19 15 13.2	+18 03 10	S	19130+1757	M7	LT Sge	
48	19 15 22.6	+17 27 52	A		M3	LU Sge	
49	19 15 27.2	+15 47 55	S	19131+1542	M8	V1349 Aql	*
50	19 15 26.8	+18 57 48	S	19132+1852	M8	LV Sge	
51	19 15 32.9	+15 51 37	S			V1350 Aql	
52	19 15 37.9	+17 11 33	S	19133+1706	M8	LW Sge	
53	19 15 40.4	+16 09 44	S	19134+1604		V1351 Aql	*
54	19 15 37.4	+19 18 05	A	19134+1912	M5	LX Sge	
55	19 15 44.6	+17 03 11	S	19134+1657		LZ Sge	*

Table 1: The Rosin–Guzzi Variables (cont'd.)

[RG78]	RA (2000)	Dec	s	IRAS	spec	GCVS4	Remarks
56	19 15 43.7	+17 20 44	A	19135+1715		LY Sge	
57	19 15 45.1	+18 43 29	S			MM Sge	
58	19 16 33.9	+18 22 52	A	19143+1817	M8	MN Sge	
59	19 16 37.7	+16 30 45	S	19144+1625		MO Sge	
60	19 16 39.9	+18 28 07	S			MP Sge	
61	19 17 06.1	+17 30 46	S	19148+1725	M8	MQ Sge	
62	19 17 16.0	+17 19 30	S	19150+1714	M10	MR Sge	*
63	19 17 20.6	+16 51 54	S			MS Sge	*
64	19 17 25.8	+17 55 18	S	19152+1749	M4	MT Sge	
65	19 17 34.4	+16 44 52	S	19153+1639		MU Sge	
66	19 17 51.4	+18 34 14	S	19156+1828	M6	MV Sge	*
67					M3	MX Sge	*
68	19 17 56.3	+16 27 18	A			MW Sge	*
69	19 17 59.5	+16 48 26	S	19157+1642	M6	MY Sge	
70	19 17 59.6	+18 33 54	S		M4	MZ Sge	*
71	19 17 59.5	+20 01 25	G	19158+1955	M5	NO Sge	GSC 1607-0201
72	19 18 03.0	+17 41 48	S	19158+1736	M8	NN Sge	
73	19 18 05.3	+18 48 23	S	19158+1842		NP Sge	
74	19 18 08.5	+18 52 40	A		M5	NQ Sge	
75	19 19 08.1	+20 49 11	S			NS Sge	
76	19 19 33.4	+19 59 03	S	19173+1953	M8	NT Sge	*
77	19 19 41.7	+19 24 47	S	19175+1919	M8	NV Sge	
78	19 19 43.8	+18 27 23	S		M10	NU Sge	
79	19 19 49.3	+19 41 51	S	19176+1936	M8	NX Sge	
80	19 19 54.9	+17 33 32	A	19176+1728	M8	NW Sge	
81	19 19 57.8	+18 19 37	S		M9	NY Sge	
82	19 20 01.3	+20 21 28	S	19178+2015	M6	NZ Sge	
83	19 20 04.7	+19 53 23	S	19178+1947	M8	OO Sge	
84	19 20 13.2	+18 25 45	S		M6	OP Sge	*
85	19 20 29.0	+17 31 38	S		M5	OQ Sge	
86	19 20 54.9	+20 24 54	S			NZ Vul	
87	19 21 03.1	+20 02 34	S	19188+1956	M9	OO Vul	*
88	19 21 04.1	+19 32 54	A	19189+1927	M6	OP Vul	
89	19 21 07.2	+20 02 08	S			OQ Vul	
90	19 21 20.7	+20 06 13	S	19191+2000	M9	OR Vul	
91	19 21 21.0	+20 30 14	S	19191+2024	M8	OS Vul	
92	19 21 39.9	+20 01 30	S	19194+1955		OT Vul	
93	19 21 47.6	+19 49 39	S			OU Vul	
94	19 21 53.8	+19 02 22	S			OR Sge	*
95	19 22 09.3	+18 18 54	S	19199+1813		OS Sge	
96	19 22 14.5	+19 40 53	S		M8	OV Vul	
97	19 22 18.1	+17 31 06	S	19200+1725	M6	OT Sge	
98	19 22 24.2	+20 03 45	G	19202+1957	M6	OW Vul	GSC 1608-0373
99	19 22 30.2	+17 58 22	S	19202+1752	M8	OU Sge	
100	19 22 32.1	+19 53 02	S	19203+1947	M9	OX Vul	
101	19 22 45.8	+18 41 04	S	19205+1835	M6	OV Sge	
102	19 22 55.0	+18 45 04	A			OW Sge	*
103	19 22 53.9	+19 52 22	A			OY Vul	
104	19 23 29.9	+18 45 09	S	19212+1839	M8	OX Sge	
105	19 23 30.8	+18 49 41	S	19212+1843		OY Sge	*
106	19 23 51.3	+17 12 59	S	19216+1707	M6	OZ Sge	
107	19 24 08.0	+17 03 03	A			PP Sge	*
108	19 24 20.7	+20 00 27	S	19221+1954	M6	OZ Vul	
109	19 24 53.2	+19 01 16	S	19226+1855	M8	PQ Sge	
110	19 25 10.0	+19 12 14	S		M6	PR Sge	

Table 1: The Rosino–Guzzi Variables (concluded)

[RG78]	RA (2000)	Dec	s	IRAS	spec	GCVS4	Remarks
111	19 25 47.6	+17 37 09	S	19235+1731	M6	PS Sge	
112	19 25 49.9	+19 14 44	A	19236+1908	M10	PT Sge	*
113	19 25 49.2	+19 30 20	S		M8	PP Vul	
114	19 26 00.4	+19 40 37	S	19238+1934	M3	PQ Vul	
115	19 26 17.0	+18 12 16	A	19240+1806	M6	PV Sge	
116	19 26 17.5	+18 00 18	A	19240+1754	M6	PU Sge	
117	19 26 36.1	+19 00 27	A	19244+1854	M2	PW Sge	
118	19 26 39.7	+17 44 13	S	19244+1738		PX Sge	
119	19 27 05.9	+19 19 35	S	19249+1913	M10	PY Sge	
120	19 08 45.0	+17 41 22	S	19065+1736	M6	IL Sge	*
121	19 13 35.8	+16 09 48	S			V1346 Aql	
122	19 19 04.2	+18 30 55	S			NR Sge	
123	19 27 25.8	+18 26 39	S	19252+1820		PZ Sge	*

Notes

7 ID somewhat uncertain; position is for the northwestern star of a merged pair.
10 this is not the M-dwarf G 142-11.
12 south-southeastern star of a pair.
18 crowded; position is for southwestern of two stars.
36 western star of a merged pair.
37 northern star of a pair.
40 southeastern star of a pair.
49 western of two stars.
53 ID uncertain: alternate candidate at end-figures $40\overset{s}{.}7/44''$.
55 southwestern star of a trio.
62 northern star of a merged pair.
63 position is just within the error ellipse of IRAS 19151+1646.
66 in the field of cluster Palomar 10.
67 chart does not match the star field at the nominal position.
68 northeastern star of a merged pair.
70 in the field of cluster Palomar 10.
76 northeastern star of two.
84 ID uncertain: position is for the southwestern star of a merged pair.
87 GSC 1608-0453, position slightly offset due to crowding.
94 western of two stars.
102 position is just outside the error ellipse of IRAS 19207+1839.
105 northwestern of two stars.
107 Rosino & Guzzi $+1°$ Dec error.
112 northwestern star of a pair.
120 southwestern star of a pair.
123 ID uncertain: position is for the southmost star of a trio.

COMMISSIONS 27 AND 42 OF THE IAU
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VARIABLE STARS IN THE GLOBULAR CLUSTER M12

NGC 6218 (M12, C1644-018, l = 15°.7, b = 26°.3) is a variable-poor cluster. It is an intermediate metallicity cluster with concentration class IX, apparent radius $r = 7'.2$ (Kukarkin, 1974) and tidal radius $r = 13'.4$ (Webbink, 1985).

The only variable found in this cluster by Sawyer-Hogg (1938) is a long-period Cepheid. Later Clement et al. (1988) confirmed her result that it was a W Vir variable (number 1 in Table 1) and discovered its period to be unstable, ranging from $15^{\mathrm{d}}.50$ to $15^{\mathrm{d}}.55$.

In our investigation we study four fields with the common size of $4'.3 \times 4'.3$. One may find details of the observations and data reduction in the paper by Brocato et al. (1996). Search for variable stars in the cluster was made in the same way as described in our previous paper (Kadla et al., 1996). From 18 V and 20 B frames we selected for our study 8 B,V pairs with the time interval between B and V exposures shorter than 10 min. There are two stars (numbers 2 and 3 in Table 1) in the instability strip of the colour – magnitude diagram (Figure 1) that can be considered as RR Lyrae variable candidates. Unfortunately the duration of observations was insufficient to confirm the variability of these stars. Data for suspected variables (coordinates, V magnitudes and colour $B - V$) are listed in Table 1.

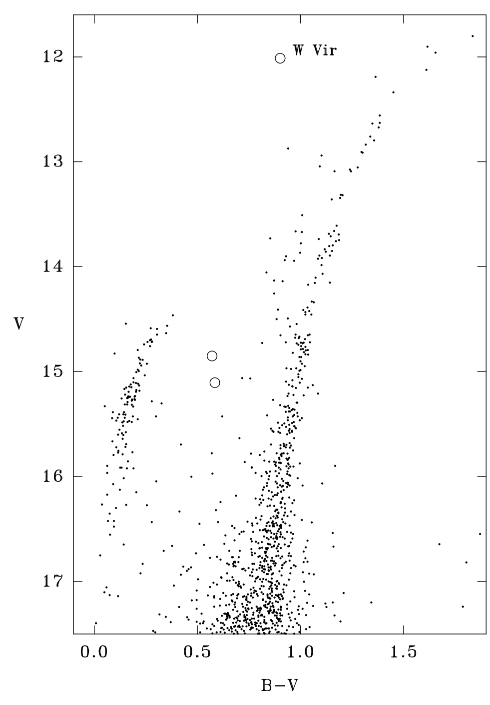
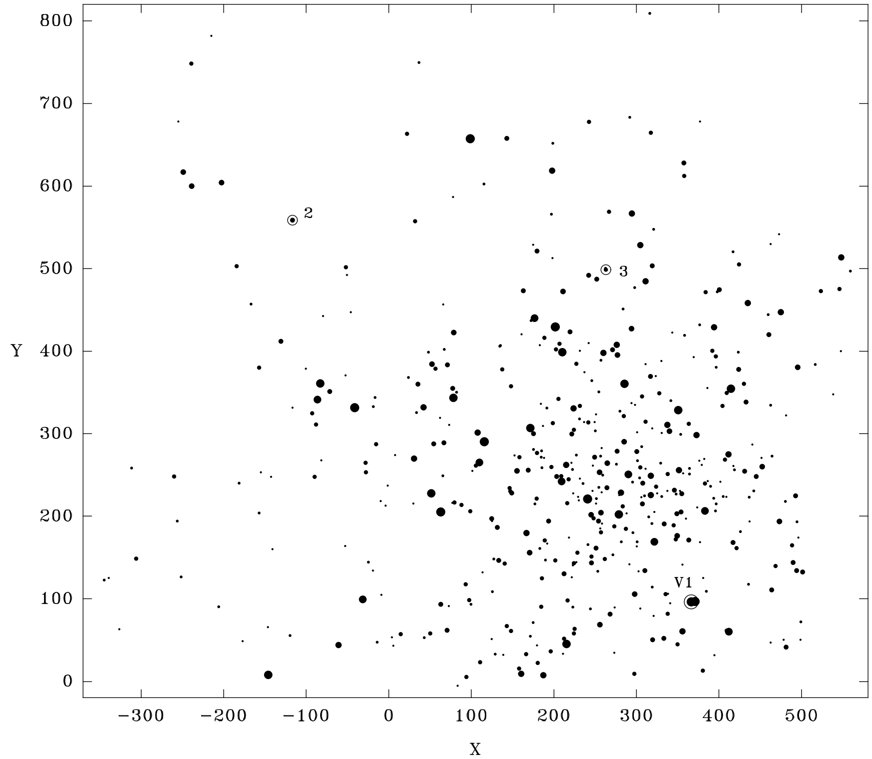


Figure 1. The color - magnitude diagram for the globular cluster M12, suspected variables are marked by circles



A finding chart for M12, suspected variables are denoted by circles

Table 1. Positions and photometric data for suspected variables

N	X pixels	Y pixels	V	$B-V$
1	366.00	96.52	12.02	0.90
2	−116.63	558.41	14.85	0.57
3	262.75	498.57	15.11	0.58

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SUDDEN PERIOD CHANGE IN THE CONTACT BINARY AW UMa?

The orbital period change of the contact binary AW UMa was firstly reported by Woodward et al. (1980). Hrivnak (1982) considered it as a sudden decrease of the period from one constant period (0.43873231 days) to another one (0.43872917 days), which occurred around 1976 or as a continuous decrease. Due to the lack of observations it was impossible to decide, which type of period change occurred.

Our UBV photoelectric observations were carried out at the Stará Lesná Observatory (SL) in 1995-1997, Skalnaté Pleso Observatory (SP) in 1992 and 1996 and Kryonerion Station of the National Observatory of Athens (K) in 1982 and 1986. The telescopes and their equipments are described in Hric et al. (1991). BD +31°2270 was used as the comparison star. U, B, V light curves of AW UMa based on the 1995 and 1996 data are depicted in Figure 1. Mid-eclipse brightening was registered in the secondary minimum (Pribulla and Chochol, 1997). Derman et al. (1990) and Bakos et al. (1991) reported pronounced light and colour variations of AW UMa in 1989-90. Our light curves show that AW UMa is in a quiet phase now. The times of minima and their standard errors, determined using Kwee and van Woerden's (1956) method are given in Table 1.

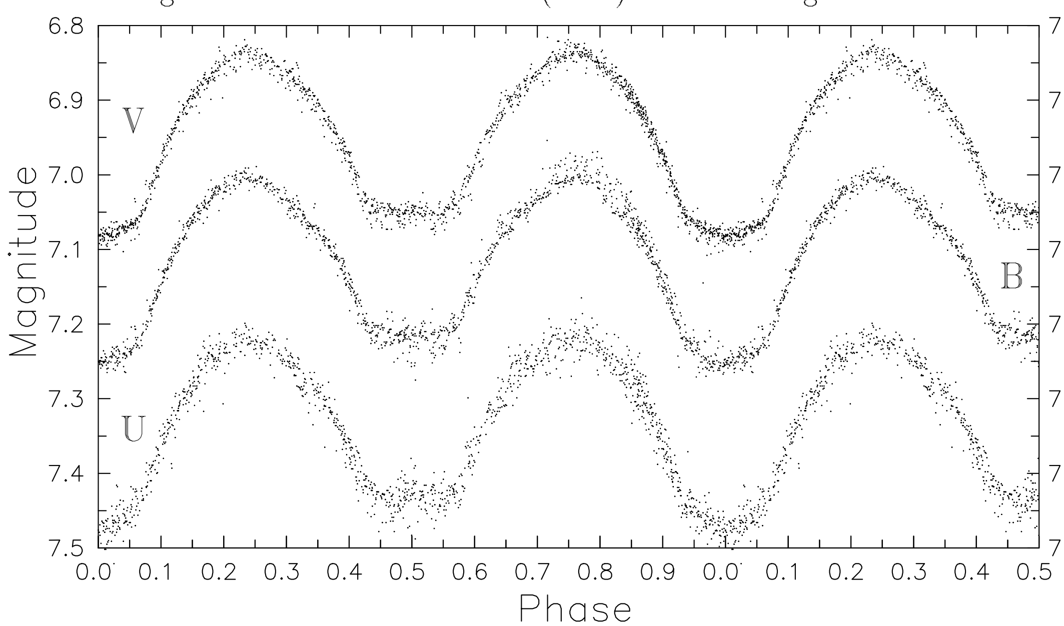

Figure 1. U, B and V light curves obtained at Stará Lesná Observatory in 1995 and 1996. Phases were calculated using the ephemeris (2).

Table 1. Times of minima of AW UMa

JD_{hel} 2400000+	σ $\times 10^{-4}$	Min.	Obs.	Filt.	JD_{hel} 2400000+	σ $\times 10^{-4}$	Min.	Obs.	Filt.
45107.4766	2	I	K	BV	50139.4693	2	II	SL	UBV
45108.3531	4	I	K	BV	50141.4447	3	I	SL	UBV
46514.4813	10	I	K	BV	50161.4076	3	II	SL	UBV
46515.3586	3	I	K	BV	50421.571	10	II	SP	UBVR
48683.5554	5	I	SP	V	50423.5438	4	I	SL	UBV
49778.3977	2	II	SL	UBV	50428.5918	1	II	SL	UBV
49862.4120	5	I	SL	UBV	50430.5640	3	I	SP	UBV
50096.478	10	II	SL	UBV	50461.4979	4	II	SL	UBV
50097.5706	2	I	SL	UBV	50465.4433	1.5	II	SL	B
50098.4489	0.2	I	SL	UBV	50471.5855	1	II	SL	V

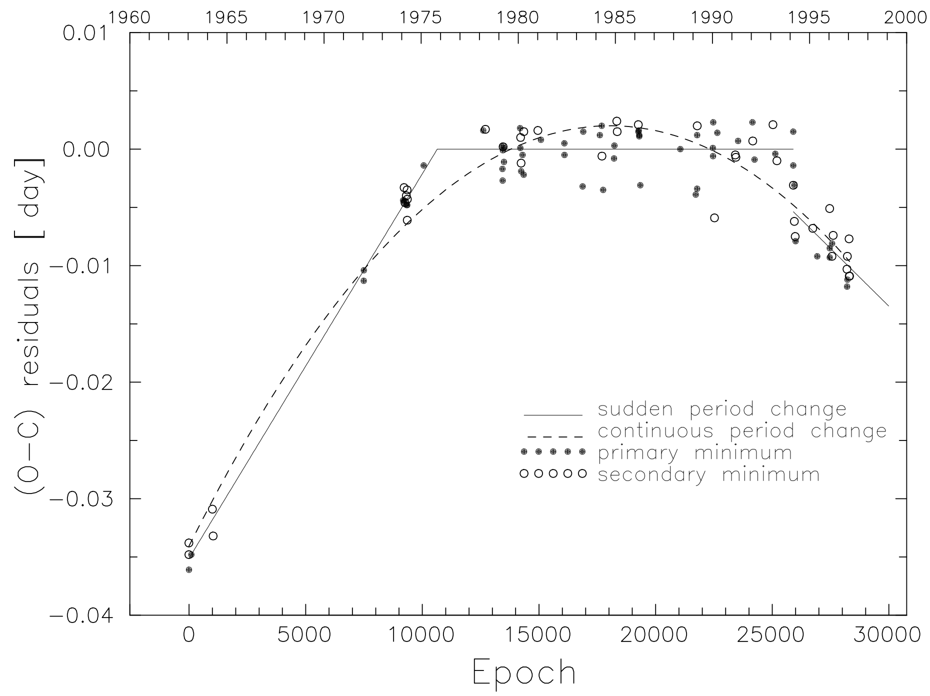

Figure 2. The O−C diagram

The times of minima given in Table 1 together with the data published by Yim and Jeong (1995) and Müyesseroğlu et al. (1996) as well as the data compiled from literature by Bakos et al. (1991) and Demircan et al. (1992) were used to study period change. The O−C residuals (Figure 2) were calculated using the ephemeris:

$$\text{Min I} = HJD\,2\,438\,044.8164 \;+\; 0\overset{d}{.}43872901 \times \; E. \tag{1}$$

As it is apparent from Figure 2, the data could be explained either by two sudden period changes, which occurred in 1976 and 1994 or by a continuous period change. The linear ephemeris between the two sudden period changes (1975-1994) is identical with ephemeris (1). The period 0.43873231 days determined by Hrivnak (1982) and our ephemeris (1) indicate a period jump $\Delta P/P = 7.5 \times 10^{-6}$. The minima after the second jump are defined by the following linear ephemeris:

$$\text{Min I} = \text{HJD}\,2\,438\,044.8625 + 0\overset{d}{.}43872703 \times E \tag{2}$$

The corresponding period jump ($\Delta P/P = 4.4 \times 10^{-6}$) is smaller than the first one. The data in Figure 2 fitted by a parabola (continuous period change) are represented by the following ephemeris:

$$\mathrm{Min\,I} = \mathrm{HJD}\,2\,438\,044.7824 + 0\overset{\mathrm{d}}{.}43873301 \times E - 1.105\ 10^{-10} \times E^2 \qquad (3)$$

The sum of squares of the residuals for the three linear fits ($2.5\ 10^{-5}d^2$) is half of that for the quadratic fit ($5.0\ 10^{-5}d^2$), therefore the sudden period change seems to be more probable than the continuous one.

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TWO VARIABLE STARS IN AURIGA: THE NEW CLASSICAL CEPHEID NSV 01771 AND THE NEW ECLIPSING BINARY SYSTEM GSC 2906.0213

The variability of NSV 01771 (= CSV 006139 = VB 11 = GSC 2906.0279) was first announced by Horn-d'Arturo and Lacchini (1955). In the NSV catalogue (Kholopov, 1982), NSV 01771 is recorded as an RR Lyrae star with a photographic amplitude of 1.8 magnitudes. During the autumn of 1996, a variable star search carried out with the 0.4-m telescope at Mollet del Valles Observatory (Spain) revealed that this suspected variable had a period too long for an RR Lyrae star. To study more thoroughly its nature, it was monitored in the V band with the 0.6-m telescope at Esteve Duran Observatory (Spain) using a CCD camera. Observations were also performed with the 0.5-m telescope at L'Ametlla del Valles Observatory. NSV 01771 was observed for 21 nights from 7 October to 19 December 1996. GSC 2906.0069 was used as comparison star and GSC 2906.0213 as check star.

Photometric data shows that NSV 01771 is not an RR Lyrae star, but a classical Cepheid with a period close to 3.4 days which can be unambiguously identified with GSC 2906.0279, an object with an average photovisual magnitude (PAL-V1 filter) of 12.0 according to the Guide Star Catalogue. Its amplitude in the V band is of $0\overset{\mathrm{m}}{.}93 \pm 0\overset{\mathrm{m}}{.}02$. The phase curve (Figure 1) presents an asymmetry factor (M−m)/P=0.2. The following ephemeris was computed:

$$\begin{array}{l}\text{Max.} = \text{HJD}\,2450416.64 + 3\overset{\mathrm{d}}{.}4075 \times \text{E} \\ \qquad\qquad\qquad\quad \pm 0.02 \pm 0.0015\end{array}$$

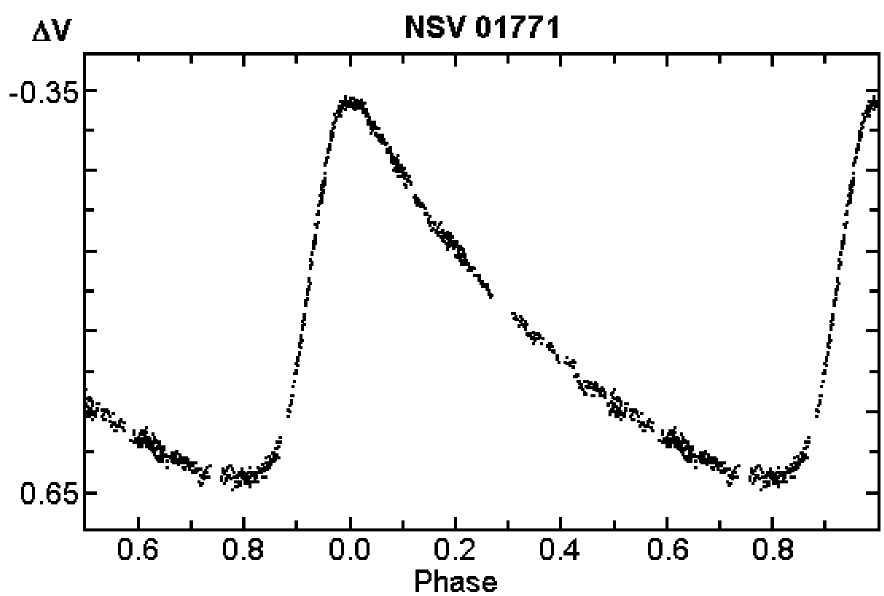

Figure 1

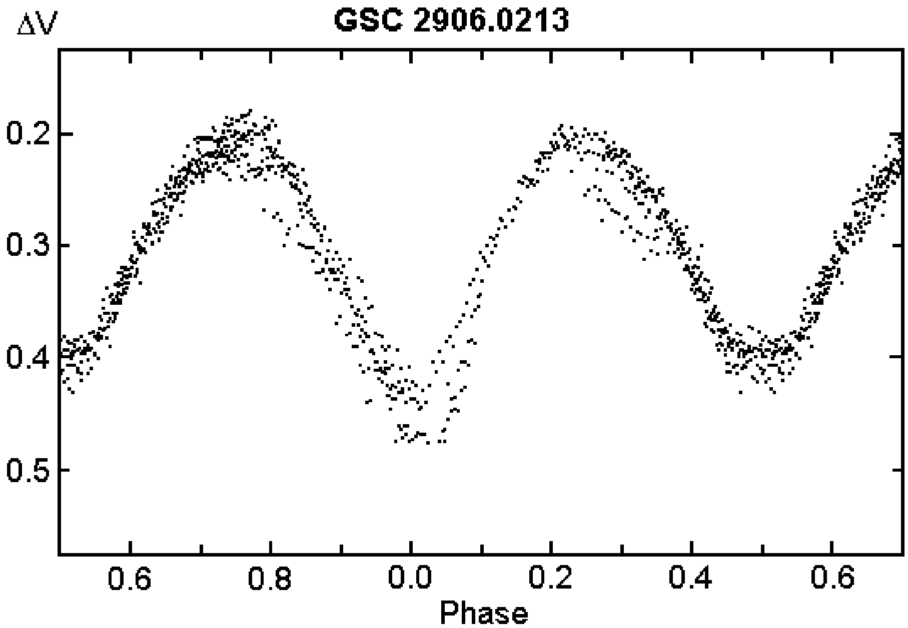

Figure 2

Brightness measurements obtained from archival plates would allow to improve the above given ephemeris and also study its light-curve in the past. In addition to this, spectroscopic and more photometric data would help to obtain additional relevant information about this new pulsating star.

CCD reductions yielded that the check star GSC 2906.0213, located about 43 arcseconds to the Southwest of NSV 01771 is also variable. According to the Guide Star Catalogue, its photovisual magnitude (PAL-V1 filter) is 12.7. This object is an eclipsing binary star with a period close to 0.9 days, and has an amplitude of $0\overset{m}{.}24 \pm 0\overset{m}{.}04$ at primary minimum and $0\overset{m}{.}19 \pm 0\overset{m}{.}02$ at secondary minimum in the V band. Phase curve (Figure 2) presents higher dispersion around primary minimum than around minimum II. Simultaneous observations performed with two different telescopes showed that this is due to cycle-to-cycle changes in the shape of the light-curve, probably as a consequence of some form of stellar activity. Although data scatter does not allow to compute the physical parameters of this binary system, a preliminary study suggests that the primary component is about 10 times as massive as the secondary one. Minimum I is a transit whereas minimum II is an occultation.

Due to the unstable shape of primary minimum, ephemeris to predict times of minima was derived for minimum II:

$$\begin{array}{rl} \mathrm{Min.\,II} = \mathrm{HJD}\,2450395.5073 & +\ 0\overset{d}{.}91279 \times \mathrm{E} \\ \pm 0.0025 & \pm\ 0.00020 \end{array}$$

A list of minimum II timings and O$-$C residuals for the above given ephemeris was also obtained after using the Kwee and van Woerden's (1956) method. These are given in Table 1.

Table 1

HJD	O–C
2450373.5962	−0.0041
2450374.5139	0.0008
2450395.5073	0.0000
2450416.4998	−0.0016
2450437.4940	−0.0016

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PHOTOELECTRIC BVI_c OBSERVATIONS, NEW ELEMENTS AND A NEW CLASSIFICATION FOR BZ Tuc

BZ Tuc = HV 821 was included in our program of photoelectric observations for Cepheids because it is listed in GCVS-IV as a classical Cepheid with the elements

$$MaxJD = 2444141.64 + 127.61 \times E.$$

We observed the star at CTIO during September-November 1996 using the 1.0–m reflector. A total of 26 BVI_c measurements were obtained (Table 1), the accuracy of the individual data being near $\pm 0\overset{m}{.}01$ in all filters. Our new observations are plotted as filled dots in Figure 1, while open circles refer to our earlier observations (Berdnikov & Turner, 1995).

The slight offset of the new observations from our earlier observations in Figure 1 suggests that our data do not satisfy the above elements. In order to refine them, we analyzed all available published observations using Hertzsprung's method; the derived epochs of maxima, listed in Table 2, together with times of maxima from Leavitt (1908), were introduced into a linear least squares solution to obtain the following improved ephemeris:

$$MaxJD = 2430242.8 + 127.447 \times E.$$

Table 1

JD 2450300+	V	$B-V$	$V-I_c$	JD 2450300+	V	$B-V$	$V-I_c$
51.6601	11.794	0.793	0.874	81.6460	11.680	0.932	0.954
52.7280	11.763	0.800	0.867	82.6389	11.661	0.940	0.952
53.6278	11.756	0.808	0.867	83.6399	11.650	0.943	0.966
54.6378	11.748	0.807	0.871	84.6350	11.709	0.969	0.985
55.6658	11.784	0.799	0.872	86.6257	11.691	0.981	0.969
57.6306	11.735	0.804	0.866	87.6555	11.712	0.998	0.976
58.6354	11.738	0.811	0.867	88.6383	11.719	1.009	1.005
59.6230	11.719	0.824	0.869	89.6342	11.743	1.023	1.020
61.6585	11.700	0.823	0.865	90.6310	11.750	1.051	1.014
62.6531	11.704	0.836	0.875	91.6228	11.771	1.055	1.036
63.6294	11.706	0.820	0.889	92.6297	11.779	1.072	1.036
79.6424	11.652	0.893	0.955	93.6331	11.800	1.073	1.046
80.6372	11.669	0.948	0.954	94.6770	11.810	1.097	1.051

Table 2

$MaxJD$ 2400000+	Uncertainty	Filter	E	$O-C$	Number of Observations	Author
10097.00	–	pg	−158	−9.17	–	Leavitt, 1908
34443.23	±1.15	B	33	−5.32	10	Gascoigne, Kron, 1965
34449.94	±1.91	V	33	1.39	12	Gascoigne, Kron, 1965
41070.64	±0.33	B	85	−5.15	18	Eggen, 1977
41203.26	±0.64	V	86	0.02	25	van Genderen, 1983
41203.86	±0.48	V	86	0.63	18	Eggen, 1977
41325.48	±0.32	B	87	−5.21	23	van Genderen, 1983
41834.12	±0.40	B	91	−6.35	10	Madore, 1975
41839.31	±1.11	V	91	−1.17	10	Madore, 1975
44011.44	±1.17	V	108	4.37	9	Freedman at el., 1985
44135.92	±0.85	V	109	1.40	6	Harris, 1980
44515.26	±0.29	B	112	−1.60	34	Caldwell, Coulson, 1984
44521.02	±0.34	V	112	4.16	37	Caldwell, Coulson, 1984
50117.60	±0.31	V	156	−6.92	32	This paper
50238.23	±0.24	B	157	−13.74	30	This paper

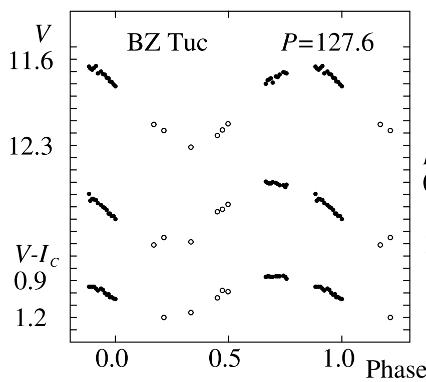

Figure 1. The light curve of BZ Tuc established by our earlier observations (Berdnikov & Turner 1995), open circles, and the observations of Table 1, filled circles

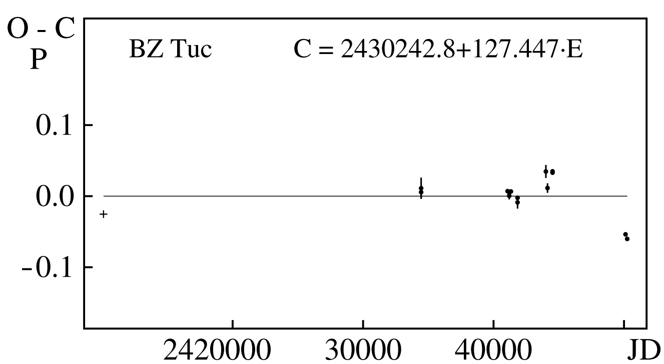

Figure 2. The O−C diagram for BZ Tuc. For convenience the O−C values are expressed in fractions of the period

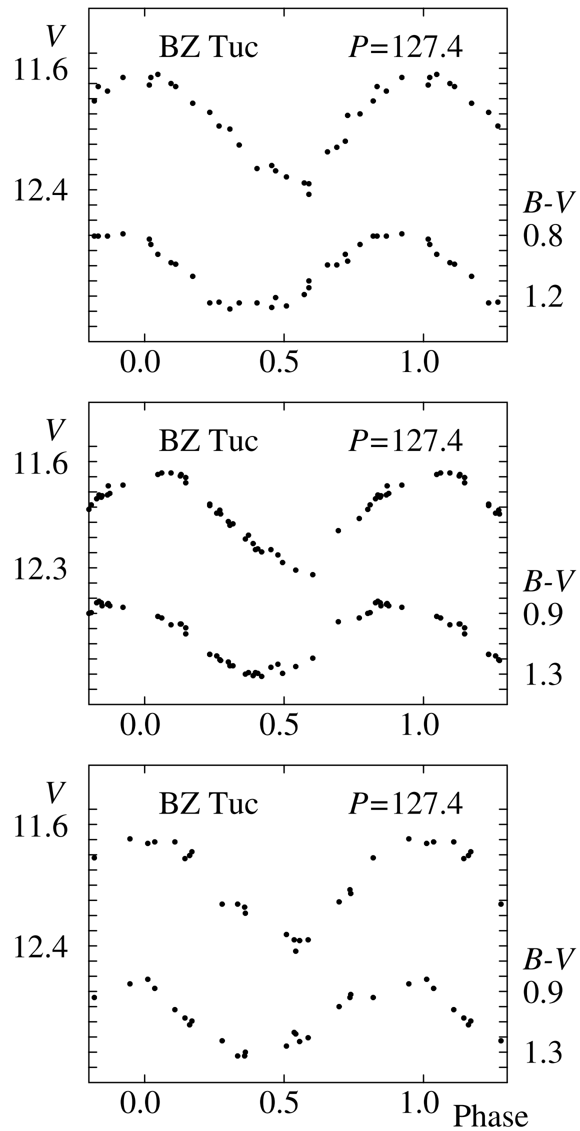

Figure 3. The light curve of BZ Tuc according to van Genderen (1983), top, Caldwell & Coulson (1984), middle, and Eggen (1977), bottom

The new ephemeris was used to calculate the $O - C$ values listed in Table 2, as well as for plotting Figures 2 and 3. In both Table 2 and Figure 2 we have taken into account that maxima in filter B precede those in V by 6.0 days. The data of Figure 1, as well as the observations of van Genderen (1983), Caldwell & Coulson (1984), and Eggen (1977), which are replotted in Figure 3a–c for the new ephemeris, indicate that the shape of the light curve of BZ Tuc varies slightly. Moreover, a shift in the times of maxima for $B - V$ relative to those in V is evident. Such variability in light curve shape suggests that BZ Tuc cannot be a classical Cepheid. Likewise, it cannot be a type II Cepheid because of its very long period. Possibly BZ Tuc is an RV Tauri variable or alternatively a semiregular variable of the UU Herculis class.

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COMMISSIONS 27 AND 42 OF THE IAU
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PHOTOELECTRIC BVR_c OBSERVATIONS FOR THE UU Her STAR EV AURIGAE

EV Aur is classified in GCVS-IV as a classical Cepheid with a period of 2.659562 days. We observed this star photoelectrically in 1985 for 18 nights (JD 2446285–304) and revealed no changes is brightness (Berdnikov, 1986) with this period. Schmidt et al. (1995) observed EV Aur with CCD and suspected that EV Aur was an UU Her star with the elements

$$\text{Max JD}_{hel} = 2448578.4 + 55 \times \text{E}.$$

To examine these elements, we observed the star at Mt. Maidanak Observatory (Uzbekistan) in September 1996 using the 0.6-m reflector. A total of 7 BVR_c measurements were obtained, the accuracy of the individual data being near $\pm 0\overset{\mathrm{m}}{.}01$ in all filters. These data as well as the observations taken in 1985 are listed in Table 1 and presented graphically in Figure 1.

In Figure 2 our data (dots) are represented together with observations published by Schmidt et al. (circles). Both offset in phase and difference in shape of our light curve with respect to data of Schmidt et al. confirm their conclusion: most likely, EV Aur is an UU Her star.

The research described here was made possible in part by grant No. 95–02–05276 from the Russian Foundation of Basic Research.

Table 1

JD_{hel} 2400000+	V	$B-V$	$V-R_c$	JD_{hel} 2400000+	V	$B-V$	$V-R_c$
46285.4679	12.332	1.825	1.804	46300.4131	12.340	1.874	1.872
46287.4309	12.312	1.878	1.874	46301.4440	12.376	1.882	1.883
46288.4651	12.339	1.897	1.865	46302.4394	12.322	1.894	1.861
46289.4575	12.334	1.888	1.881	46303.4260	12.348	1.882	1.877
46290.4737	12.371	1.884	1.863	46304.4299	12.350	1.901	1.877
46291.4493	12.352	1.891	1.874	50332.4182	11.969	1.905	1.861
46293.4239	12.392	1.846	1.887	50333.4364	12.020	1.824	1.894
46294.4275	12.349	1.900	1.877	50337.4098	12.123	1.898	1.845
46295.4174	12.354	1.859	1.875	50340.4035	12.181	1.824	1.873
46296.4236	12.364	1.826	1.889	50341.4071	12.214	1.834	1.866
46297.4358	12.340	1.867	1.879	50344.4182	12.267	1.881	1.934
46298.4417	12.299	1.905	1.848	50347.4176	12.280	1.820	1.882
46299.4126	12.366	1.852	1.875				

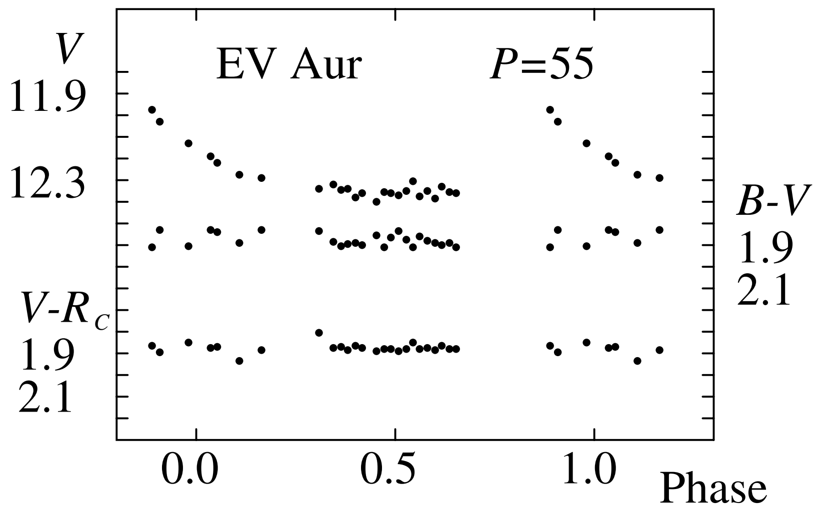

Figure 1

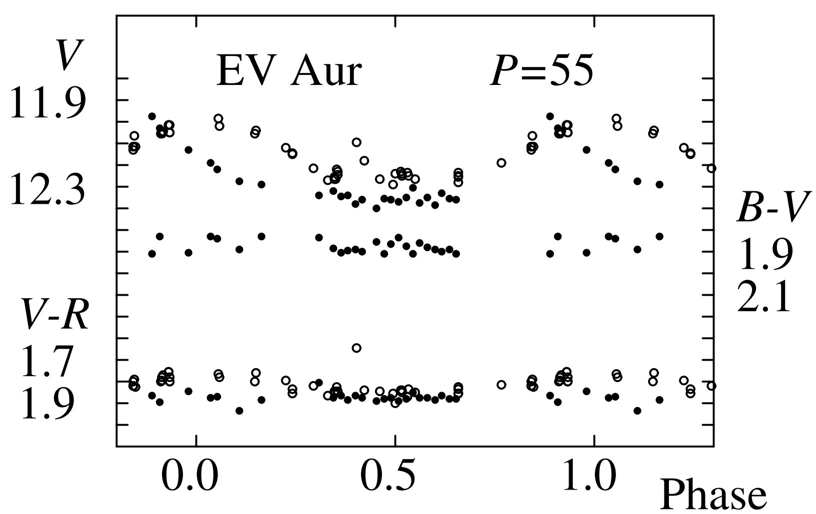

Figure 2

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OPTICAL PHOTOMETRY OF CF Tuc, MID-1995 THROUGH 1996

CF Tuc (=CABS[1] #8) is a relatively bright (V~7.5) RS CVn type binary (Hearnshaw and Oliver, 1977). It consists of a G0 type Main Sequence dwarf orbiting in a 2.797672d period (Budding, 1985; epoch HJD 2445606.9165) with a K4 subgiant. The star appears in front of the southern end of the SMC, and has received significant attention from observers in Australasia (Budding and Zeilik, 1995, and refs. cited therein).

The scale of related photometric (starspot/maculation) activity has varied from very large (tenths of mag, cf. Hall, 1981) to apparently insignificant (~0.01 mag; Budding and McLaughlin, 1987), with many observers recording irregularities on the order of 0.05 mag.

Drake *et al.* (1992) pointed out appreciable X-ray emission from CF Tuc. It is listed in the ROSAT (EUV) Bright Source Catalogue (Pounds *et al.*, 1993), and Kürster (1994) reported a very large flare observed by ROSAT. It has also been found to be a reasonably active radio source (Slee *et al*,, 1987), and this has prompted efforts toward 'multiwavelength' observational studies (Gunn *et al.*, 1996). The present article attempts to put together recent photometric information as a background to such multiwavelength studies, involving further observations at the Australia Telescope in June 1996, which covered a complete orbital cycle of the binary.

In Figure 1 we show data which has been collected from two sites in New Zealand from mid-1995 up to the end of the year. The earliest points, observed from the Kotipu Place Observatory's APT ('KPO' — cf. Hudson *et al.*, 1993) may be slightly brighter than the later trend towards a low secondary minimum. This is in the sense that later KPO data, combined with that from T Rounthwaite, indicate that towards the end of 1995 there was a reasonably coherent maculation wave, centering at phase around 0.6. This wave may have previously been at a higher phase and subsequently drifted down in longitude. Such effects are frequently observed for RS CVn stars showing spot-waves, and the rate of this drift for CF Tuc has been found to be typically of order 50 deg per year (Budding and Zeilik, 1995), in keeping with what could be expected from the trends studied by Henry *et al.* (1995), although appreciable variations in the apparent rates of spot drifts are found in particular cases.

Figure 2 indicates that the maculation wave continued its downward migration into 1996, decreasing somewhat in amplitude in the process. The overall rate of drift over the whole of 1996 would then appear to be about 100 deg, and if the drift was uniform over this period then the phase of the main minimum should have been about 0.45 at the time of the radio observations in Australia carried out at the end of June, 1996.

[1]CABS refers to the Catalogue of Strassmeier *et al.* (1993).

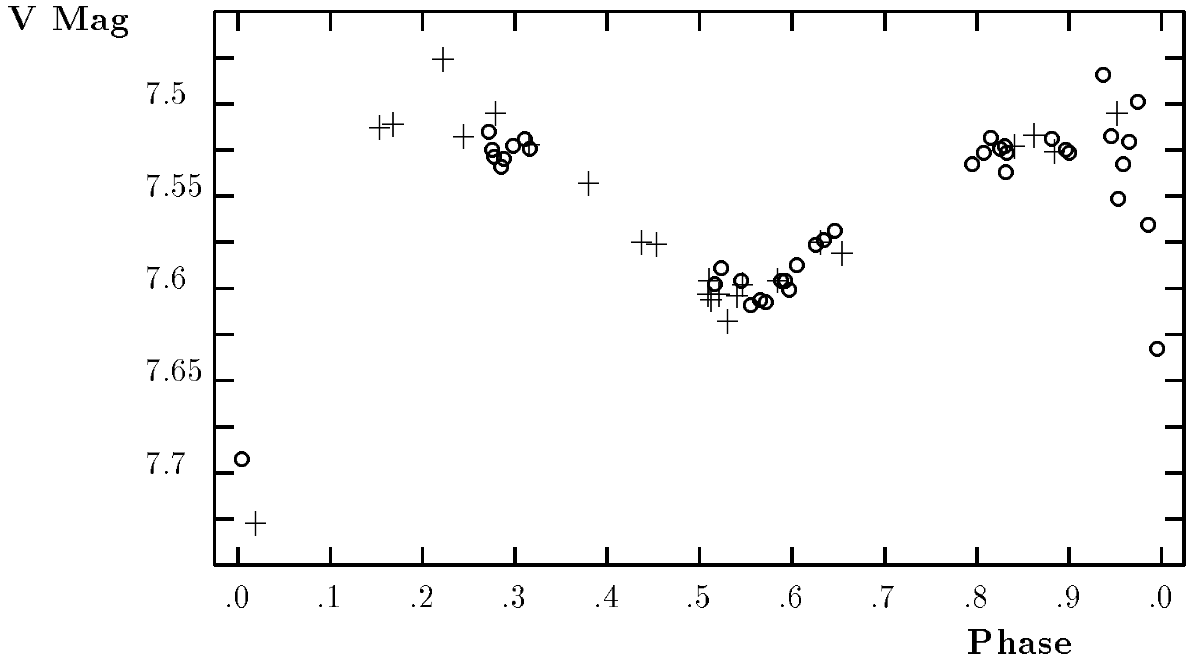

Figure 1: V light curve of CF Tuc: Aug-Dec 1995; KPO (∘) & Rounthwaite (+).

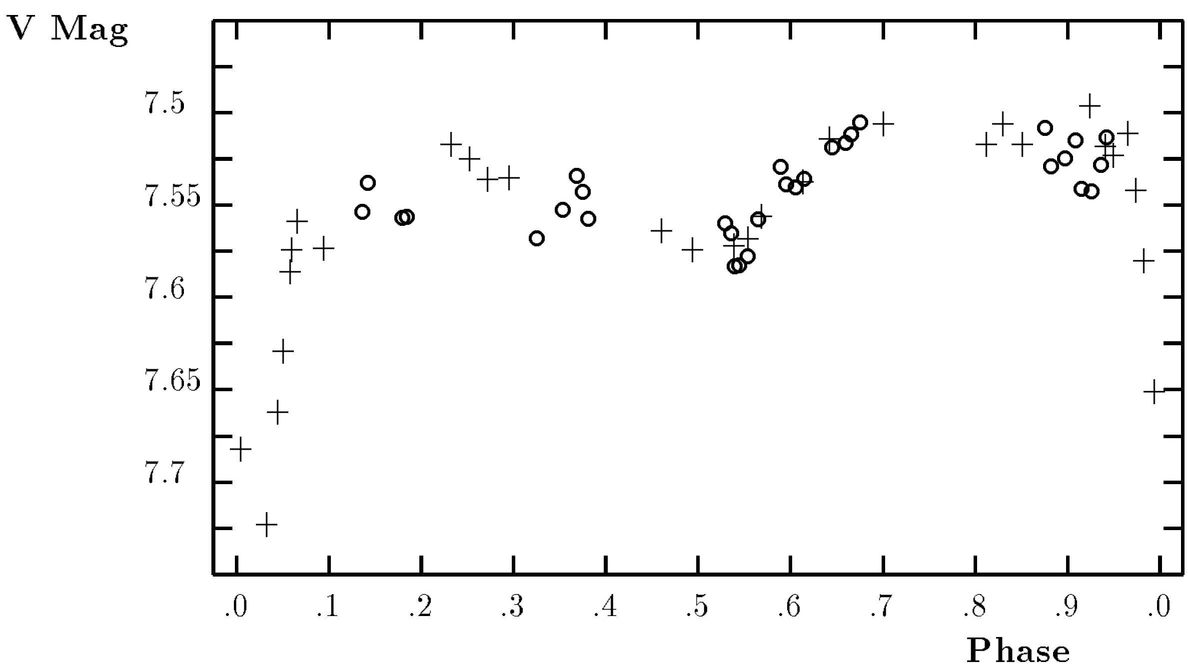

Figure 2: V light curve of CF Tuc: Jul-Dec 1996; KPO (∘) & Rounthwaite (+).

Data continue to be assembled and checked as part of a wider programme of active star studies. More intensive and detailed analyses can be expected in further stages of this programme.

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A SUSPECTED RED VARIABLE IN THE ERROR BOX OF GRB 970111

GRB 970111 is a gamma–ray burst detected by the satellite BeppoSAX on January 11, 1997 (Costa et al. 1997). Soon after the event, we observed the field of GRB 970111 (Guarnieri et al. 1997) with the 1.5-meter telescope (+BFOSC) of the Bologna University and compared it to the Digitized Sky Survey (DSS). We noticed on the R frames the clear presence of a star (Figure 1) which was barely visible on the DSS (whose limiting magnitude is $R \sim 20.5$). The star is also practically invisible on the Palomar Sky Survey red plates and absent on the blue ones (limiting magnitude $\sim$ 21 for both). From the DSS we deduced the coordinates of this object:

$$\alpha{=}15^{\mathrm{h}}28^{\mathrm{m}}45^{\mathrm{s}};\ \delta{=}{+}19°47'15'' \text{ (equinox 2000.0)},$$

with a conservative error of ±5" for both values. The star is inside the GRB 970111 error box communicated by Hurley et al. (1997; see also Figure 1). No variable object within a circle of radius 10' and centered on these coordinates is mentioned in the SIMBAD database.

From 5 frames (3 in R band, 1 in B and 1 in V, respectively) collected between Jan. 15 and Jan. 31 1997, we determined the magnitudes of the star by means of the DAOPHOT II package (Stetson 1987) and the *ALLSTAR* procedure implemented in MIDAS. The entire log of observations, together with the Palomar data, is reported in Table 1.

Table 1. Available magnitudes and color indices for the variable

JD	B	V	R	$B-V$	$V-R$	Source
2433391.90	>21	—	∼21	—	—	Palomar plates
2450463.68	—	—	19.90	—	—	1.5m+BFOSC
2450465.71	—	—	19.93	—	—	1.5m+BFOSC
2450479.65	>21	20.34	19.80	∼1.2	0.54	1.5m+BFOSC

The calibration has then been performed with the use of the photometric standards in the field of PG 1047+003 (Landolt 1992). The star, on January 15 1997, was at $R = 19.90 \pm 0.05$, thus showing a variation of more than a magnitude with respect to the Palomar red plates (April 1950), while on January 17 the R magnitude was 19.93 ± 0.05. On January 31 its magnitude in the R band was found to be 19.80 ± 0.05. During the same night, its $V-R$ color index was 0.54. Unfortunately, the object was too faint to be visible in the B band, even with an exposure time of 50 minutes; we can however give an indicative $B-V$ color index of $\sim$1.2 by comparing the $V-R$ of the star with those of field stars with known $B-V$ color indices. These colors suggest that this object is a mid–late K spectral type star, depending on the luminosity class (Lang 1992). All this seems to indicate that this suspected variable might be a long period red star.

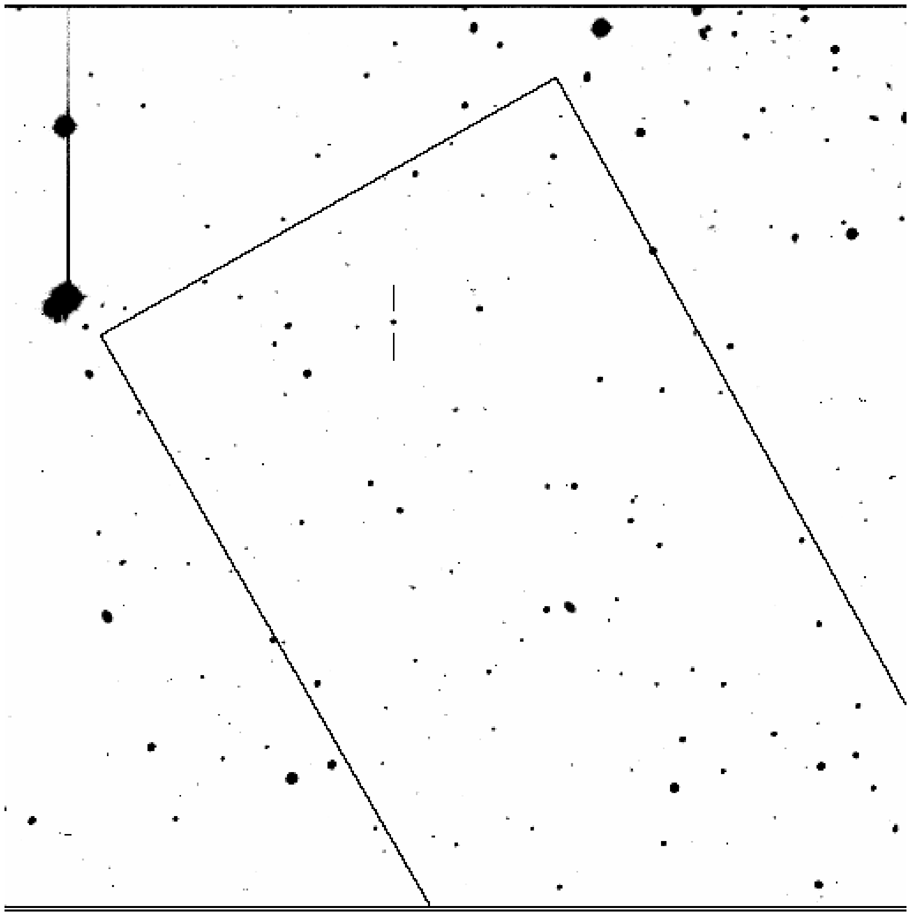

Figure 1. The field (9'×9') of the suspected variable in the Johnson R band (exposure time: 20 minutes), observed on January 15, 1997. The star is indicated by the ticks. North is at top, east is to the left. The northern part of GRB 970111 error box by Hurley et al. (1997) is also reported

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IDENTIFICATION OF VARIABLES NEAR NGC 7635

A group of new and known variable stars in the field of the emission nebula NGC 7635 was studied by Rosino, Bianchini, and Martino (1976). In the source paper, approximate positions, spectral types, and elements of variation were presented along with finder charts for the thirty-two new variables. All but one of these are now named variables. Although the positions provided are generally accurate, they are not precise. For the fainter stars especially, precise positions are required both for their recovery for further study at the telescope and for linkage within other surveys such as IRAS.

The tables below give precise positions and identifications for all the stars. Table 1 matches the Rosino *et al.* Table 1 in showing the variables already known at the time of publication. The sources of the positions are coded in column 's' as follows:

A A1.0 (Monet *et al.* 1996)
G GSC, version 1.1
P PPM
S SkyView
U UJ1.0 (Monet *et al.* 1994)

For stars not in any available catalogue, I used the Goddard SkyView facility (Scollick 1997) to estimate positions from the Digitized Sky Survey to $\pm 2''$ using a coordinate-grid overlay. The positions for MO Cas and MP Cas, which lie in the bright nebulous region of NGC 7635, were given erroneously by Rosino (1953). At the request of G. Williams, amateur observer D. diCicco obtained CCD frames that allowed measurement of their positions, which are given here.

The spectral types are copied directly from Rosino *et al.*; those in parentheses were taken from the literature. An asterisk in the final column indicates a note at the bottom of the tables.

Table 1

Name	RA (2000)	Dec	s	GSC	spec	n
CC Cep	23 01 28.5	+61 40 19	U		G/K?	
AS Cep	23 02 05.2	+59 49 06	G	3997-0641	M3	
CR Cas	23 04 52.0	+59 33 57	G	3997-1059	K8:[sic]	*
DP Cep	23 08 21.1	+61 12 00	G	4278-0009	F0	
PV Cas	23 10 02.5	+59 12 07	P		(B6$^-$V)	
GU Cep	23 10 10.9	+61 14 30	G	4279-0027	M3	
V Cas	23 11 40.6	+59 41 58	P		(M5-7e)	
CI Cep	23 11 26.8	+62 58 24	G	4283-0552	M5e	*
HQ Cep	23 12 46.8	+61 26 32	U			

Table 1 (cont'd.)

Name	RA (2000)	Dec	s	GSC	spec	n
OQ Cep	23 12 57.0	+60 34 38	U		M7	*
CY Cep	23 20 09.3	+63 01 23	A			*
MO Cas	23 20 43.6	+61 14 43	*		M8	*
MP Cas	23 20 39.6	+61 13 53	*		M8	*
CH Cas	23 22 28.5	+62 45 26	G	4283-1264	(F3pIb)	*
V398 Cas	23 22 30.9	+59 18 26	P		M5	
DQ Cas	23 24 57.4	+62 18 51	G	4283-0555	M5	
V433 Cas	23 25 12.1	+61 19 29	G	4279-0165	M6	*
PW Cas	23 25 58.5	+61 16 01	G	4280-1499	F8/G0	
IS Cas	23 28 28.7	+60 33 57	G	4280-1578	A2	
CY Cas	23 29 12.8	+63 22 28	G	4284-0433	(G0-G2Ib)	
DR Cas	23 30 53.4	+62 07 23	G	4284-0602	M2?	*
V530 Cas	23 30 44.1	+60 15 21	G	4280-1989		*
V435 Cas	23 31 27.3	+59 24 25	U			*
DS Cas	23 32 21.0	+62 06 33	G	4284-0514	C	
V438 Cas	23 36 00.0	+62 03 12	A		M8	
RS Cas	23 37 16.1	+62 25 45	G	4284-0674	(F8-G2Ib)	

Table 2, containing Rosino *et al.*'s new variables, is arranged in a similar way. Because the stars are somewhat fainter, few of them appear in the GSC; IRAS identifications are shown instead following the positions.

Table 2

No.	Name	RA (2000)	Dec	s	IRAS	spec	n
1	PZ Cep	22 56 55.2	+60 25 10	S	22549+6009		
2	QQ Cep	22 59 43.9	+60 53 25	U			
3	V352 Cep	23 01 27.0	+61 33 50	P			*
4	QR Cep	23 01 50.9	+61 40 07	A	22598+6123	M10:	
5	NSV 14394	23 02 01.5	+61 53 04	A	22599+6136		
6	QS Cep	23 03 03.7	+61 30 18	A	23009+6113	M4/5	
7	QT Cep	23 05 58.4	+60 15 00	S		M6:	*
8	QU Cep	23 06 19.4	+60 04 31	A	23042+5948	M6:	
9	QV Cep	23 11 47.8	+60 34 14	G			*
10	QW Cep	23 12 28.3	+59 52 19	U	23103+5935	M7	
11	QX Cep	23 13 30.2	+62 50 33	A	23113+6234	M7	
12	QY Cep	23 13 38.1	+63 09 02	A	23115+6252	M5	
13	V569 Cas	23 15 14.9	+59 27 48	A	23130+5910	M6	*
14	V570 Cas	23 16 27.6	+59 48 18	U			
15	V563 Cas	23 16 55.3	+60 26 01	U		M6e	*
16	V571 Cas	23 19 41.5	+59 58 18	S		M	*
17	V572 Cas	23 19 57.2	+62 27 48	A		M8/10	
18	V573 Cas	23 21 14.6	+59 08 53	A	23190+5852	M7	
19	V574 Cas	23 21 31.9	+60 22 13	G	23193+6005	M5	*
20	V575 Cas	23 21 55.2	+62 03 03	A		M2/4e	
21	V576 Cas	23 23 11.5	+61 44 40	S	23209+6128	M6	

Table 2 (cont'd.)

No.	Name	RA (2000)	Dec	s	IRAS	spec	n
22	V577 Cas	23 23 33.7	+60 28 23	U			
23	V578 Cas	23 25 07.2	+59 03 04	A			
24	V579 Cas	23 25 55.3	+60 57 31	G		M5	*
25	V581 Cas	23 29 58.0	+60 28 12	A	23276+6011	M8	
26	V583 Cas	23 31 16.1	+61 32 19	S	23289+6115	M	
27	V584 Cas	23 31 47.7	+61 02 46	A	23294+6046	M6/8	
28	V585 Cas	23 33 59.0	+61 04 10	A	23316+6047	M5	
29	V587 Cas	23 37 45.5	+60 59 39	A	23354+6043	M6	
30	V586 Cas	23 35 16.7	+61 35 25	U		M3	*
31	V582 Cas	23 30 11.3	+60 16 46	G		M5	*
32	V580 Cas	23 28 15.4	+60 28 59	G	23259+6012	M2	*

Notes:

Table 1

CR Cas LS III +59°40. GCVS4 spectral type in error: *cf.* Popper (1996).
CI Cep IRAS 23093+6242
OQ Cep S 5686. Rosino *et al.* -1^{m} RA error.
CY Cep ID verified with chart in Rosino (1943).
MO Cas position from CCD frames by diCicco.
MP Cas position from CCD frames by diCicco.
CH Cas large Rosino/GCVS4 RA error, ID verified with chart in Parenago & Kukarkin (1940).
V433 Cas IRAS 23229+6102 = Case 264 = CGCS 5875.
DR Cas IRAS 23286+6150.
V530 Cas S 5744.
V435 Cas large Rosino *et al.*/GCVS4 position error, ID verified with chart in Hoffmeister (1967).

Table 2

3 = V352 Cep HD 217692.
7 = QT Cep southmost star in the nebulous patch BFS 17 = GM 1-79.
9 = QV Cep GSC 4279-1936.
13 = V569 Cas southern star of a merged pair on DSS.
15 = V563 Cas IRC +60395.
16 = V571 Cas [LRS87] 172 = CGCS 5847.
19 = V574 Cas GSC 4279-2403.
24 = V579 Cas GSC 4280-0617 = IRAS 23236+6040 = C* 3188 = CGCS 5877.
30 = V586 Cas GSC 4280-1006 = IRAS 23329+6118. large Rosino *et al.* position error.
31 = V582 Cas GSC 4280-1858; Rosino *et al.* Dec error; located on north side of sparse 3′ cluster.
32 = V580 Cas GSC 4280-1884.

This work was facilitated by the use of SIMBAD, maintained by the Centre de Données Astronomique, Strasbourg, France; I appreciate the efforts of Gérard Jasniewicz (Université de Montpellier) to integrate these stars into the database. The U. S. Naval Observatory PMM catalogues, which were prepared by Dave Monet and colleagues at USNO-Flagstaff, were an indispensable aid in identifying the fainter stars. My thanks to Gareth Williams for providing the positions for MO Cas and MP Cas.

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GSC 1657.1754: A NEW DEEPLY ECLIPSING BINARY SYSTEM IN DELPHINUS

[BAV Mitteilungen Nr. 95]

The 10.5 magnitude star GSC 1657.1754 ($21^h06^m26\overset{s}{.}1$ +19°24'35") has recently been found to be variable on films taken over the last 7 years as part of the UK Nova/Supernova Patrol Programme. Details of the discovery and early observations are given by Collins et al. (1996). Initial reports of the variation were circulated electronically (Hurst 1996a) and the star has also been given the designation TAV J2106+194 (Hurst 1996b). On the survey films (Kodak Tech Pan 2415) the star was seen mostly at $m_{\rm pv} \sim 10.5$ but occasionally it faded below the limiting magnitude of ~ 11.8 suggesting an eclipsing binary with a period of near 10.35 days. Extensive visual observations confirmed the initial estimate of the period and further showed that the star faded below $m_{\rm v} \sim 12.4$. The eclipse history of the star has also been followed on plates of the Sonneberg and Hartha Observatories' sky patrols taken over the past 35 years. The plates are blue sensitive ORWO ZU2 (Kodak 103a-O like) and the exposures were typically 30 mins. The variable is visible throughout the primary eclipse and yielded 15 times of minimum. These are collected with the other photographic and visual times of minimum in Table 1. A more complete discussion of these observations will be published elsewhere.

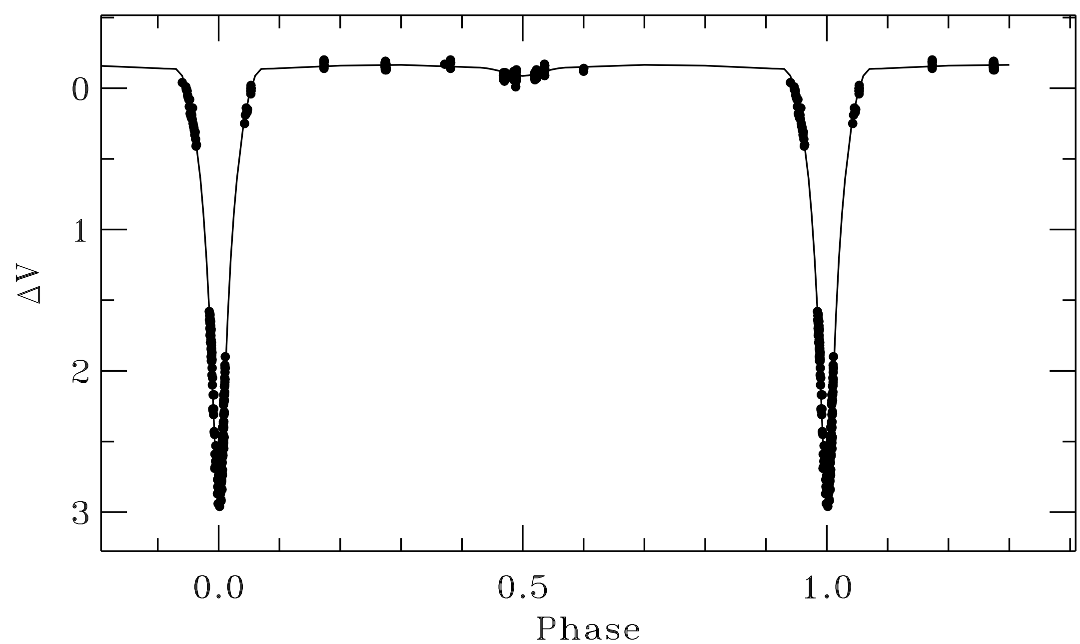

Figure 1. Light curve from the CCD observations with the model fit overlaid. The magnitude differences are relative to star D on the finding chart (Figure 4) GSC 1657.1766, which is given as $10\overset{m}{.}6$ in V

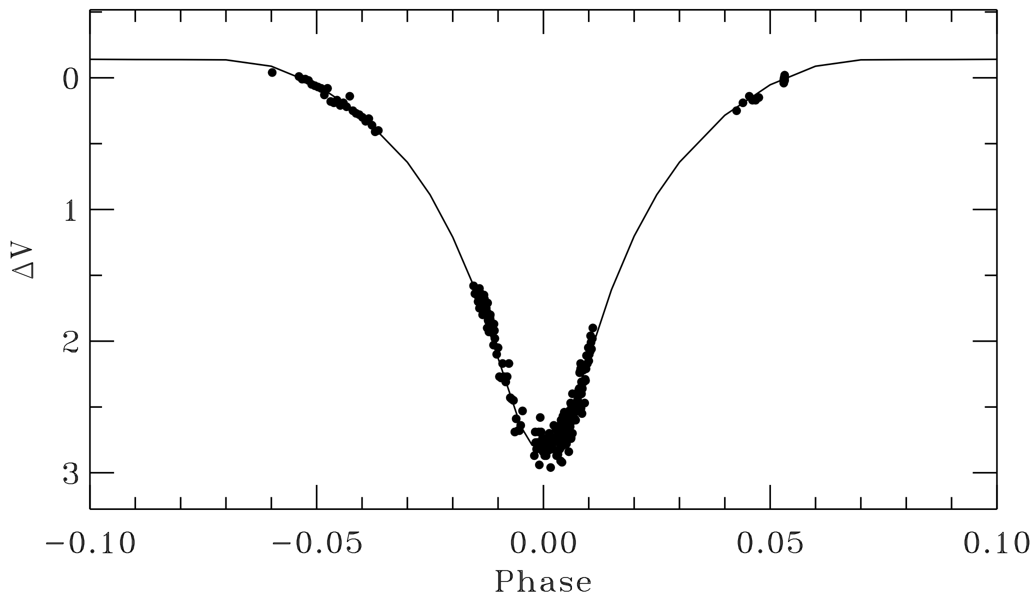

Figure 2. Detail of primary minimum with the model fit superimposed

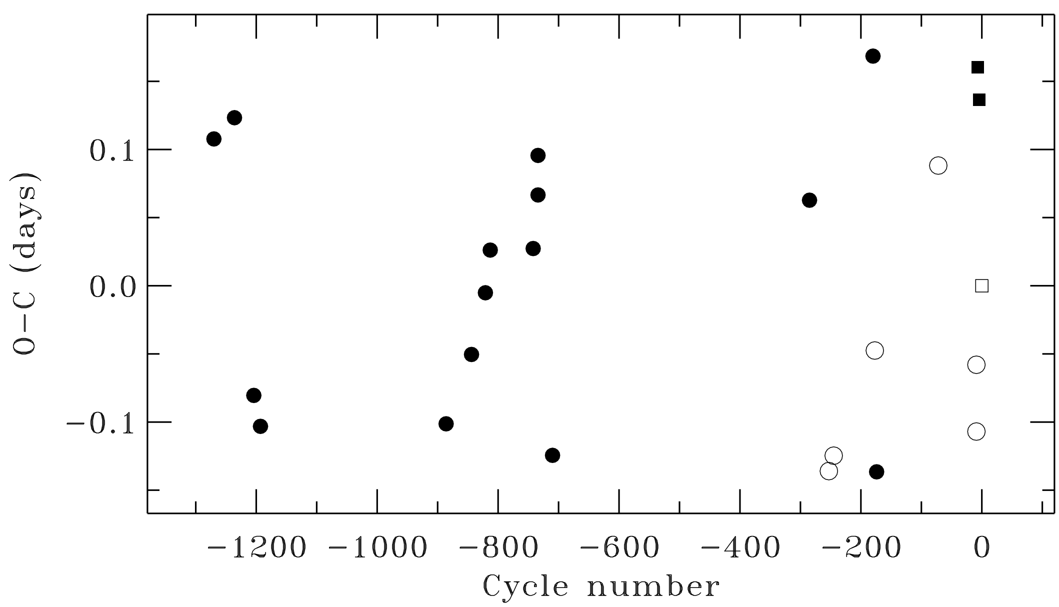

Figure 3. O−C diagram of the times of minima using the ephemeris given in the text. The photographic, photovisual, visual and CCD timings are plotted as filled circles, open circles, filled squares and an open square respectively

Since discovery GSC 1657.1754 has been observed extensively with a Starlight Xpress SX CCD and V filter on a 30-cm Newtonian telescope. Exposure times were 15 seconds and the limiting magnitude is typically 14 in V. The comparison star used was GSC 1657.1766 (V $\sim$ 10.6, star D on the finding chart, Figure 4) and the check star used was GSC 1657.1804 (V $\sim$ 12.7). The mean ΔV between the comparison and check star is 2.031 $\pm$0.065 mag which is consistent with the GSC magnitudes. The CCD observations show that the star reaches V $\sim$ 13.5, giving a primary eclipse of $\sim$ 3 mag, with a duration of just over one day. The secondary eclipse is not well defined but it probably has a depth of only $\sim$ 0.1 mag.

Table 1. Times of minima

JD	Cycle	O–C	Source	JD	Cycle	O–C	Source
2437191.404	−1270	0.1077	pg	2447719.486	−253	−0.1360	pv
2437543.399	−1236	0.1233	pg	2447802.316	−245	−0.1247	pv
2437874.470	−1204	−0.0805	pg	2448444.491	−183	0.2055	pv
2437988.323	−1193	−0.1032	pg	2448475.511	−180	0.1685	pg
2441166.492	−886	−0.1013	pg	2448506.352	−177	−0.0475	pv
2441601.341	−844	−0.0504	pg	2448537.320	−174	−0.1365	pg
2441839.490	−821	−0.0051	pg	2449593.483	−72	0.0882	pv
2441922.340	−813	0.0262	pg	2450245.485	−9	−0.1070	pv
2442657.357	−742	0.0273	pg	2450245.534	−9	−0.0580	pv
2442740.215	−734	0.0666	pg	2450266.457	−7	0.1603	vis.
2442740.244	−734	0.0956	pg	2450297.490	−4	0.1363	vis.
2442988.480	−710	−0.1244	pg	2450338.763	0	0.0000	CCD
2447388.410	−285	0.0628	pg				

Source: pg, Sonneberg/Hartha; pv, UK Nova/Supernova Patrol; vis., Visual

The times of minimum have been used to search for the period which can be determined unambiguously. The CCD observations around primary minimum have been used to derive E_0 and the period has been determined from the visual and photographic times of minimum. The ephemeris

$$\begin{array}{l} \text{Min I} = \text{HJD}\,2450338.7630 \;+\; 10.352336\times E \\ \qquad\qquad\qquad\qquad\quad \pm 18 \qquad\qquad\;\; \pm 33 \end{array}$$

is used to plot the light curves in Figures 1 and 2, and O$-$C diagram in Figure 3.

Although the light curve is not complete the combination of very deep primary minimum and weak secondary minimum clearly suggest a high inclination Algol system. The light curve has been modelled using the LIGHT2 code (Hill 1979, see also Hill et al. 1989) and it was initially assumed that the system contains a hot main-sequence star and a larger cool companion. The solution is largely independent of the initial conditions although the temperatures of the stars are poorly constrained and this produces large uncertainties in the absolute parameters of the system. The ratio of the temperatures of the components is ~ 3, with the secondary at 4500 - 5500 K while the primary is probably in the range 9000 - 15000 K. The secondary may be filling its Roche lobe, for $q \sim 0.2$, and is only slightly smaller than the Roche radius for a wide range of mass ratios. The radius of the primary is only $\sim 25\%$ smaller than that of the secondary. The inclination is 85 – 87 degrees which is on the cusp of totality. It therefore seems most likely that the system contains a mid-B to mid-A type primary and a G - K subgiant secondary. If the primary is hot then the system may be similar to AU Mon or if it is somewhat cooler, VW Cyg. For all likely masses of the primary its radius is a factor of ~ 2 larger than would be expected for a main-sequence star, so this component would also seem to be evolved.

This new variable is a relatively rare example of a long-period Algol with very deep eclipses. As it is rather brighter than most of the stars in this group it should be a useful object for testing the evolutionary models of these systems and should repay further study.

It is a pleasure to acknowledge the management and staff of the Sonneberg Observatory for their help in accessing the Sky Patrol plates.

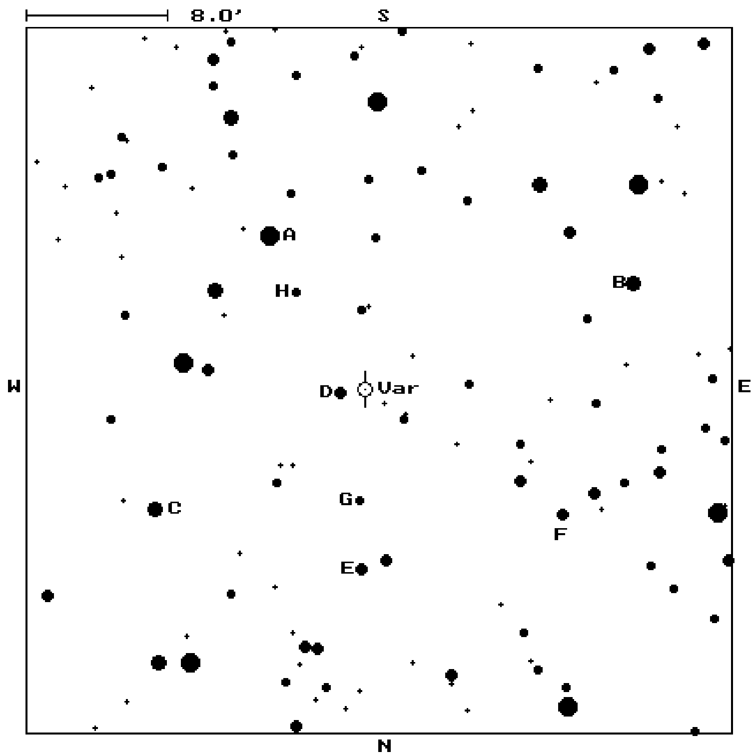

Figure 4. Finding chart for GSC 1657.1754 taken from Collins et al. (1996). The comparison is star D. South is up and the field is 40 arcmin square

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HD 193084: A NEW VARIABLE STAR

The detection of variability in HD 193084 (V = 7.5; CD−30°17822, SAO 189139) is reported. HD 193084 was used as one comparison star for the two λ Bootis stars HD 193256 and HD 193281 during our survey to detect pulsation within this group. Both λ Bootis stars and the second comparison star (HD 194170) turned out to be constant with an upper limit of 3 mmag in Strömgren b (Paunzen et al. 1996; Paunzen et al. 1997). Observations were performed at ESO during three nights (see Table 1 in Paunzen et al. 1997). A detailed description of the observation and reduction procedure can also be found in Paunzen et al. (1997).

Variability in the brightness of HD 193084 is clearly evident in all three nights. Figure 1 shows the differential light curves of HD 193084 and HD 193256 for the first night in Strömgren v. Furthermore, the data for HD 193256 − HD 194170 are presented to show the good photometric quality of the night and to establish the variability for HD 193084.

Using the data of all three nights, a time series analysis results in a period of about 80 minutes and an amplitude of 20 mmag in Strömgren v. The high statistical significance ($\approx 15\sigma$) compared to the mean noise level proves the found period. Since Figure 1 shows that a semi-regular (or multiperiodic) behaviour is evident, these results are just first numerical estimations.

In order to determine the nature of variability, a search for informations in SIMBAD was performed. Houk (1978) classified this star as B8 V with a quality flag 1 (best). Unfortunately, no photometric measurements in one of the common systems (Geneva, Johnson or Strömgren) were found making a calibration impossible. Following this spectral type, a possible δ Scuti pulsation can be excluded since the hot border of the instability strip ends at A0. Looking for other sources of variability among B-type stars, a possible membership in the β Cephei group (stars hotter than B4 with luminosity classes II to IV) and Be group (emission line stars with shells, periods $\gg$ hours and amplitudes $\gg$ 0.1 mag, e.g. Pleione, γ Cas, S Dor, etc.) is very unlikely. One may speculate that HD 193084 is an unrecognized spectroscopic binary with a pulsating A-type component. Also a false classification by Houk (1978) cannot be ruled out.

In order to unambiguously establish the location of HD 193084 in the Hertzsprung–Russell–diagram and thus to determine the nature of variability, photometric and spectroscopic observations are very much needed. The author, therefore, encourages further observations as well as collaborations for solving the nature of HD 193084.

Acknowledgements: This research was carried out within the working group *Asteroseismology-AMS* with funding from the Fonds zur Förderung der wissenschaftlichen Forschung (project *S7303-AST*). Use was made of the SIMBAD database, operated at CDS, Strasbourg, France.

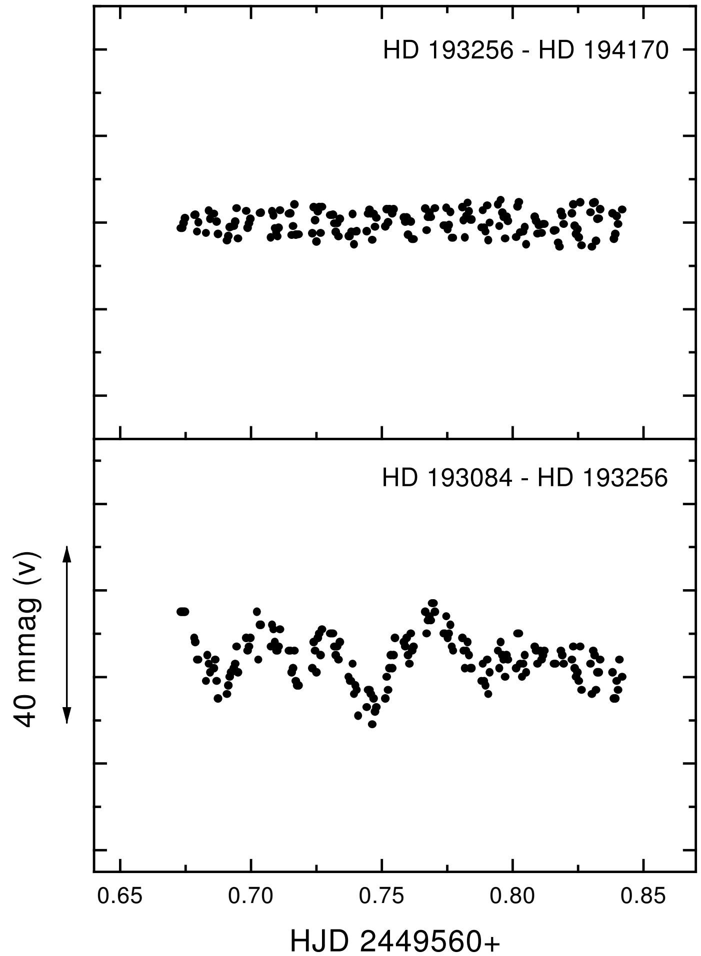

Figure 1. The differential light curves for HD 193084 − HD 193256 and HD 193256 − HD 194170 for the first night in Strömgren v

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DETECTION OF 43 NEW BRIGHT VARIABLE STARS BY THE TYCHO INSTRUMENT OF THE HIPPARCOS SATELLITE

The Tycho experiment on board of the Hipparcos satellite has led to a photometric catalogue that promises to improve our knowledge about variable stars greatly (Mauder, Høg, 1987). For about one million stars up to B=12 (completeness up to 10.7 mag) the brightness in two spectral bands (Tycho-V and Tycho-B, similar to Johnson-V and Johnson-B) is given at 100 to 400 moments, which are spread over the four-year lifetime of the satellite (1989-1993).

This database has great advantages against archived photoplates that are usually used to search for new variable stars. On the one hand, the brightness is given in magnitudes, no further photometric reduction is necessary. On the other hand, the moments of observations are almost completely independent of seasons and daytimes. This is important for variables having a period of about one day or one year, what makes them hardly detectable by ground-based observations.

We have searched the Tycho Mean Photometric Catalogue (TPMC) and the Tycho Photometric Observations Catalogue (TPOC 2) for new variable stars using merely two criteria. The first one is that variability causes a scattering of the brightnesses at single observations with respect to their median value. Therefore, the error of this median will be larger than one would expect for a constant star, if the amplitude of the variability is strong enough (Grossmann, private communication). The other criterion does only affect periodic variables. Periodogram analysis (Horne, Baliunas 1985) has been done with the time series from the catalogue. The height of maxima in the periodogram yields a probability for a correct period determination (Scargle 1982), that is usually more than 99% for the stars presented here.

This analysis is strongly affected by the extremely uneven sampling. The smallest time interval between two single measurements is about one second, but there can be several months without any observation of the star. This leads to instabilities of maxima in the periodogram. We tried to overcome this problem by computing the periodogram over different time intervals, but this is only an improvement and not a complete solution. The measurement technique of Tycho causes another problem: The presence of field stars in the neighborhood of a program star and especially an unknown multiplicity of the star can simulate a variability that in fact does not exist. For these reasons we encourage astronomers to observe the stars that are presented here. This will lead to a better confidence for the variability and – especially – the period determinations.

The periodic lightcurves shown here were produced as follows: The data were phased with respect to the period taken from the periodogram and then binned into 20 equal parts of the period. The figures show to cycles. The reason for this binning is that single observations may be disturbed and can lead to wrong conclusions, if they are taken too seriously.

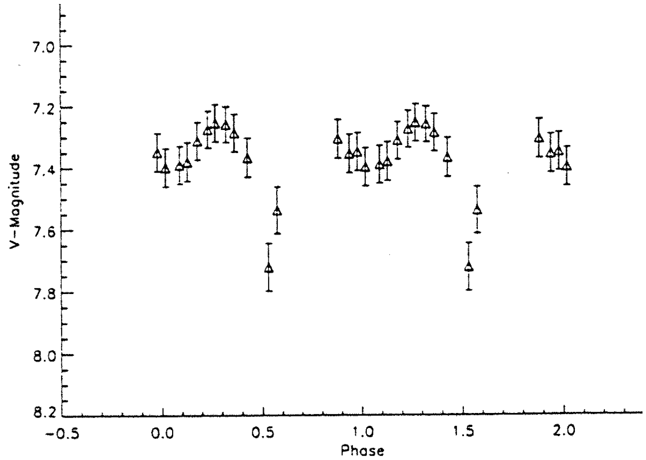

Figure 9. Phased lightcurve (P=$5^{\mathrm{d}}.252$) of the star HD 61551 in V. This may be an eclipsing binary of β Lyr type

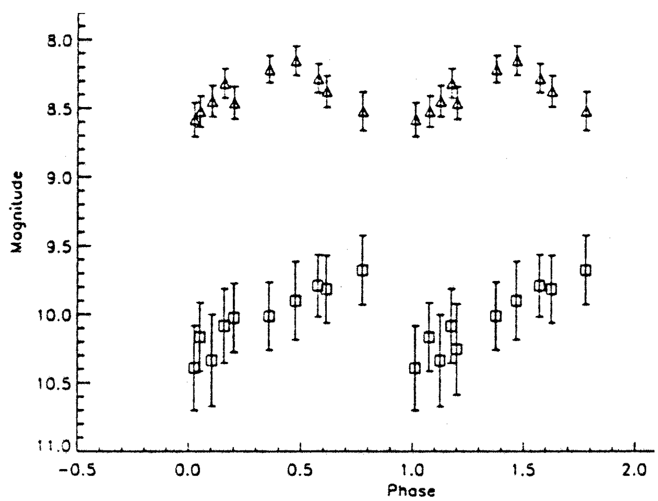

Figure 21. Phased lightcurve (P=$122^{\mathrm{d}}.0$) of the star HD 114267 in V (triangles) and B (squares). Note the variability of the colour index B−V

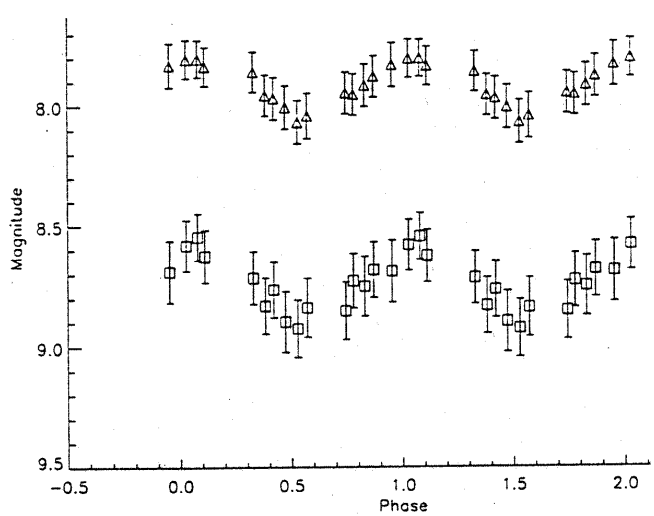

Figure 38. Phased lightcurve (P=$2^{\mathrm{d}}.91$) of the star HD 213233 in V (triangles) and B (squares)

Table 1. Results on the 43 new variables

No.	TICID[1]	Cross Identification	RA 2000.0	Dec. 2000.0	Period [days]	Type
1	3303/979/1	HD 15992	$02^{\rm h}31^{\rm m}48^{\rm s}.65$	$+49^\circ 51' 38''.0$	0.40	RRc
2	9152/1800/1	HD 22909	03 35 53.0	−69 11 35 2		L
3	2429/274/1	HD 43476	06 18 02.7	+35 35 51 5	28.4	
4	8535/222/1	HD 44363	06 18 22.3	−54 24 15 6		L
5	3769/1982/1	HD 46101	06 34 32.73	+55 21 10 5	62.9	SR
6	2426/414/1	HD 46552	06 35 37.63	+32 34 37 1	0.53	EW
7	4539/864/1	HD 60062	07 46 52.6	+81 40 56 8		
8	8551/1508/1	HD 60649	07 32 46.24	−53 33 19 3	0.49	EW
9	5405/2897/1	HD 61551	07 39 27.2	−11 33 50 9	5.52	EB
10	8911/2750/1	HD 65321	07 54 29.4	−61 12 15 8	50.3	SR
11	2504/188/1	HD 84615	09 47 20.12	+32 46 57 5		L
12	8606/502/1	HD 85025	09 47 02	−57 21		L
13	8600/3290/1	HD 90371	10 24 39.66	−54 19 19 1		L
14	9219/2587/1	HD 93325	10 44 10.2	−72 03 51	1.19	EB
15	8958/2448/1	HD 95687	11 01 35.75	−61 02 55 4	2.91	
16	8628/1620/1	HD 98434	11 18 43.92	−58 11 11 3	1.71	
17	8959/2596/1	HD 98817	11 21 06	−60 50		L
18	8972/291/1	HD 101104	11 37 34.4	−60 54 12 4	2.05	
19	7240/1270/1	HD 106865	12 17 29.58	−34 30 17 4	217	SR
20	881/680/1	HD 109983	12 38 51.5	+13 48 13 5		L
21	5537/1087/1	HD 114267	13 09 36.05	−07 46 50 5	122	SR
22	323/930/1	HD 125488	14 19 37.8	+05 53 46 8	0.20	RRb
23	8682/2013/1	HD 125687	14 22 52.1	−55 57 43 0	109	SR
24	3038/566/1	HD 126080	14 22 17.6	+41 27 03 5	0.69	RRa
25	7851/500/1	HD 143996	16 05 01.1	−39 12 57 8	12.5	
26	9039/2221/1	HD 152982	17 00 36.6	−61 24 16 8		L
27	8354/1640/1	HD 158479	17 32 10.4	−51 04 25 1		L
28	9297/1770/1	HD 160326	17 46 22.4	−72 49 18	349	SR
29	8344/931/1	HD 162985	17 56 08.32	−45 09 20 8	0.78	EA
30	3913/1509/1	HD 172022	18 34 26.3	+57 48 06 4		
31	1073/1391/1	HD 192689	20 15 53.5	+07 40 13 0		L
32	6929/1233/1	HD 197785	20 46 40.13	−27 13 59 9	11.1	EB
33	1656/2033/1	HD 200271	21 01 53.2	+18 59 54 9		L
34	8818/1040/1	HD 204611	21 32 00.6	−58 48 54 4		L
35	7990/374/1	HD 208016	21 54 22.2	−41 15 57 7	97.1	SR
36	8825/1029/1	HD 210741	22 14 02.4	−57 13 06 3		L
37	8442/1011/1	HD 212508	22 25 46.05	−49 49 34 7	6.15	
38	3619/2726/1	HD 213233	22 28 58.24	+50 57 47 4	2.91	δ Cep
39	9127/307/1	HD 223470	23 49 58.0	−61 08 08 6	1.47	
40	2772/1716/1	HD 224326	23 56 57.97	+32 20 14 3	27.95	
41	2091/1465/1	HD 341508	18 03 19.15	+23 48 53 0	5.89	δ Cep
42	6497/892/1	SAO 170690	05 40 58.7	−27 57 07 3		L
43	8958/3540/1	CSI-60-11041 1	11 06 09.0	−60 31 21	0.33	RRb

1) The TICID is the "name" of a star in the Tycho Catalogue. The first number gives the GSC-region, the second one is a running number inside this region, and the last one numbers components of multiple systems.

Because the space is limited, not all of the 43 lightcurves can be presented here. They are available on the IBVS ftp site: ftp.konkoly.hu/pub/ibvs/4401/4444-f<No.>.ps where No. is the serial number in Table 1.

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OBSERVATIONS OF THREE λ BOOTIS STARS BY USING DUAL CHANNEL PHOTOMETER

A small group of λ Boo stars attracts astrophysicists' attention owing to their controversial evolutionary status. These stars related apparently to a short-lived evolutionary phase are available for the development and control of the modern stellar atmosphere theories (Gray & Corbally, 1993). The discovery of the λ Boo stars' pulsations (Weiss et al., 1994) gives the opportunity to apply the tools of asteroseismology for their profound investigation. Observations of the variability of λ Boo stars with different equipments are widely presented in IBVS by the Vienna working group *Asteroseismology - AMS*. It should be noted, that a high quality of sky seeing and instrumentation, and long time data series are needed for such observations because the stars with relatively long periods, from 0.5 up to 4 hours, have very low amplitudes, from 0.004 mag to 0.07 mag.

During 1994-1995 we have observed 3 stars from the list of Gray & Corbally (1993) by using the dual-channel photometer (Dorokhov & Dorokhova, 1994) attached to the 0.8m Ritchey–Chretien telescope, situated in Central Asia, at the Mt. Dushak-Erekdag station of Odessa Astronomical Observatory.

HD 204041 was observed in Strömgren v-filter on two nights, 11 and 12 Oct., 1994, and **HD 38545** (C1 HD 39098, C2 HD 39019) was observed in Johnson B-filter on 20 and 22 Nov., 1995 in single channel by using 3-star mode (see Breger, 1992). Our observations confirm nonvariability of both stars within the upper limits which are higher by 0.001 mag than presented in the papers by Paunzen et al. (1996) and by Kuschnig et al. (1996).

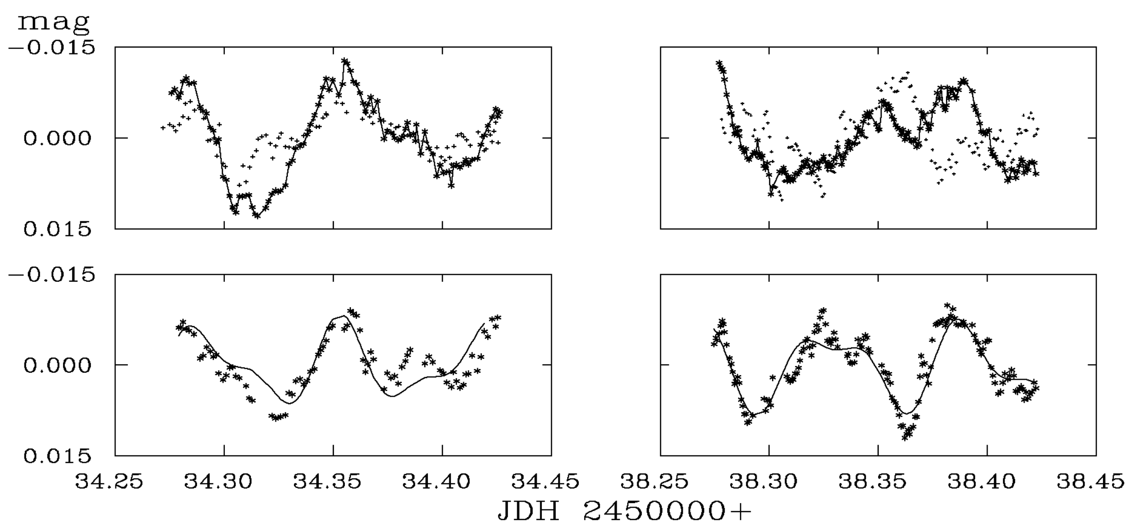

Figure 1. On the top panel: light curves for HD 221756 and comparison star HD 221903 in Johnson's B, on the bottom panel: the VAR – COM curves for two nights 12 and 16 Nov 1995. All the curves are presented as residuals to the corresponding night–means. The solid line is a least squares fit of f_1 and f_2 frequencies

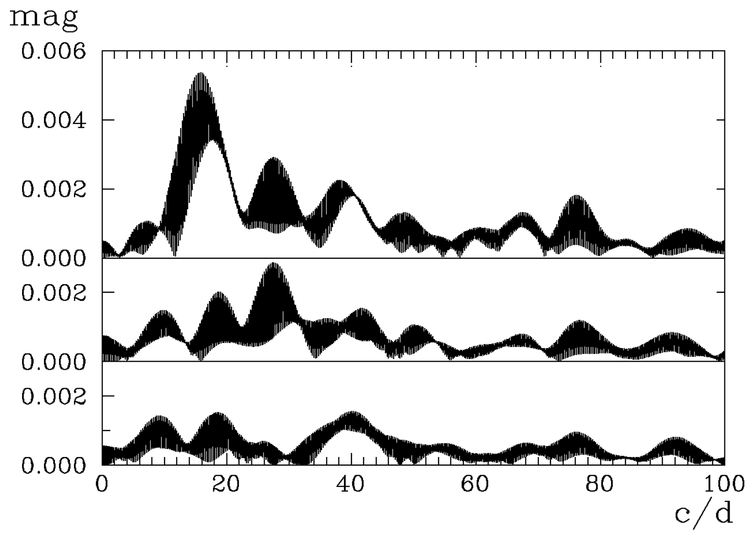

Figure 2. Fourier spectrum of both nights data. The middle panel shows the same after removal for f_1=15.85 c/d, the lower panel – the result of the prewhitening for f_1=15.85 c/d and f_2=27.54 c/d

HD 221756 was tested by Paunzen & Handler (1996) in August 1995. They obtained a period of 63 min and amplitude 6.6 mmag in Strömgren b. We observed HD 221756 and a comparison star HD 221903 (m=8.3 mag, A0) simultaneously in dual channel mode of the photometer on the nights 12/13 and 16/17 Nov 1995.The data were acquired as continuous 10 sec integrations in Johnson's B filter, interrupted by the channel reductions about one time per hour.

Then the counts of the comparison star in channel 2 were reduced to the sensitivity level of channel 1, the data were corrected for coincidence counting losses, the sky background contribution and the atmospheric extinction, and were binned to 2 min integrations by taking 12-point averages. Figure 1 shows the light curves of HD 221756 and the comparison star, and the differential data as residuals to the nightly means for each date. In order to decrease the differential data noise level, comparison star's observations were smoothed by a rectangle filter with window size=3. The solid line in Figure 1 is a least squares fit of two frequencies, which were revealed from subsequently prewhitened amplitude Fourier spectrum of common series of data (Figure 2). The packaged program PERIOD (Breger, 1990) was used for Fourier analysis. Two peaks at frequencies f_1=15.85 c/d (P=1.51 hour, A=0.011 mag) and f_2=27.54 c/d (P=52 min, A=0.006 mag) could be influenced by a 1 c/d aliasing. The result needs in further control because the variations of sky transparency may affect the such low-amplitude light curves even in the case of dual–channel photometry. Here we can only suppose that HD 221756, as well as already known HD 210111 (Paunzen et al., 1994) and 29 Cyg (Kusakin & Mkrtichian, 1996) is another example of the multiperiodicity of λ Bootis stars like that taking place in δ Scuti stars.

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VARIABLE STARS IN THE GLOBULAR CLUSTER NGC 6717

NGC 6717 ($C1852-2246, l = 12^\circ\!.88, b = -10^\circ\!.90$) according to its spectral class F8 (Hesser & Shawl, 1985) is a relatively high metallicity but poorly studied cluster. Goranskii (1979) obtained an upper part of the CMD and detected one RR Lyrae variable near the cluster center. At present the only CCD photometric study of this cluster was made by Brocato et al. (1996). Our search for RR Lyrae variables was made on the base of these CCD observations by the method described in Kadla et al. (1996).

The cluster has a small apparent angular radius $r = 1'\!.9$ (Kukarkin, 1974) and a high central concentration. For this reason the CMD was obtained for stars with $13'' < r < 120''$ (Figure 1). In the instability strip there are two stars: one is a known RR Lyr variable (V1) detected by Goranskii (1979) and the other is a suspected RR Lyr star. Their positions are shown in the cluster chart (Figure 2).

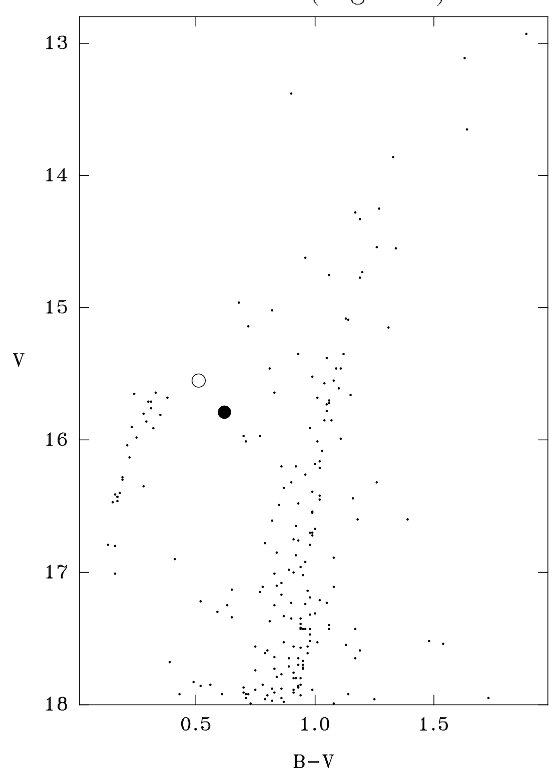

Figure 1. The color – magnitude diagram for the globular cluster NGC 6717. The known RR Lyrae star is denoted by ○ , suspected – ●

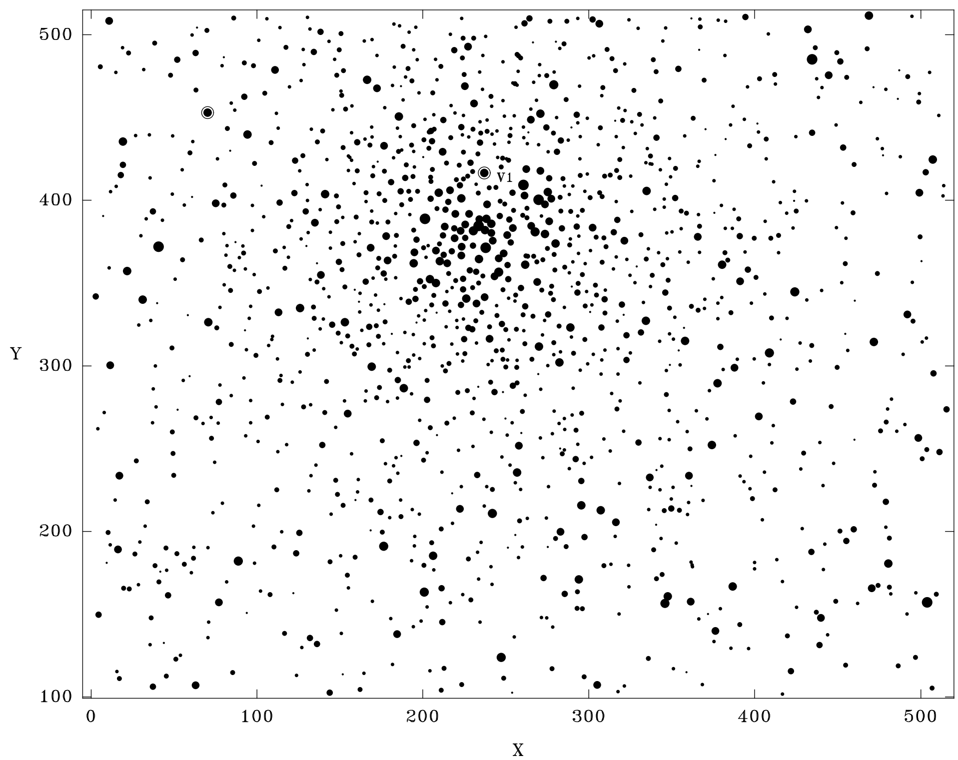

Figure 2. Chart of the cluster. Variable stars are denoted by ◯

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VARIABLE STARS IN THE GLOBULAR CLUSTER NGC 4372

The globular cluster NGC 4372 ($C1223 - 724, l = 301^{\circ}\!.0, b = -9^{\circ}\!.9$) has a low concentration (CC XII) and relatively low metallicity. Estimates of the latter range from −1.66 (Bica & Pastoriza, 1983) to −2.16 (Frogel et al., 1983). The integral spectral class, F5 (Hesser & Shawl, 1985), favours the former value. The cluster has an apparent radius $r = 9'\!.3$ (Kukarkin, 1974) and tidal radius $r = 31'\!.6$ (Webbink, 1985).

In the first two editions of Catalogue of Variable Stars in Globular Clusters (Sawyer, 1939, 1955) with reference to a communication from H. Shapley there are 3 unpublished and 11 suspected variables in the cluster. However no data are given for these stars. In a search for variables (Fourcade et al., 1966) two (type unknown) were discovered at a considerable distance from the cluster center ($r > 11'$). A further search (Kaluzny & Krzeminski, 1993) detected 19 short-period SX Phe type variables and close binaries. In the present study the search for RR Lyr type variables was made in the area $r < 4'\!.5$ using the same V and B observations (Brocato et al., 1996) in four overlapping fields with 3-6 consecutive exposures and applying the same method of search for variable stars as in our previous papers (Kadla et al., 1996a,b).

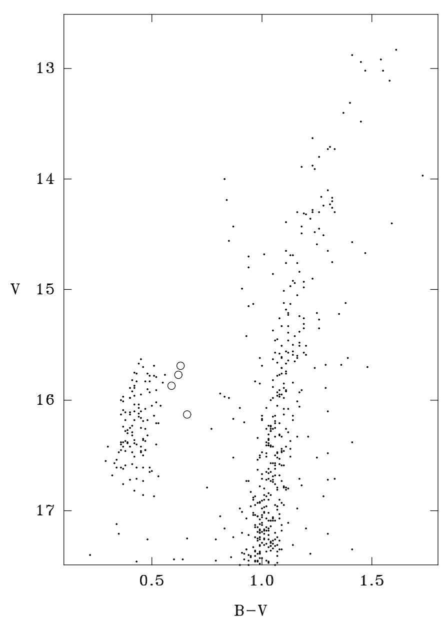

Figure 1. The color – magnitude diagram for the globular cluster NGC 4372. The suspected RR Lyrae stars are denoted by ∘

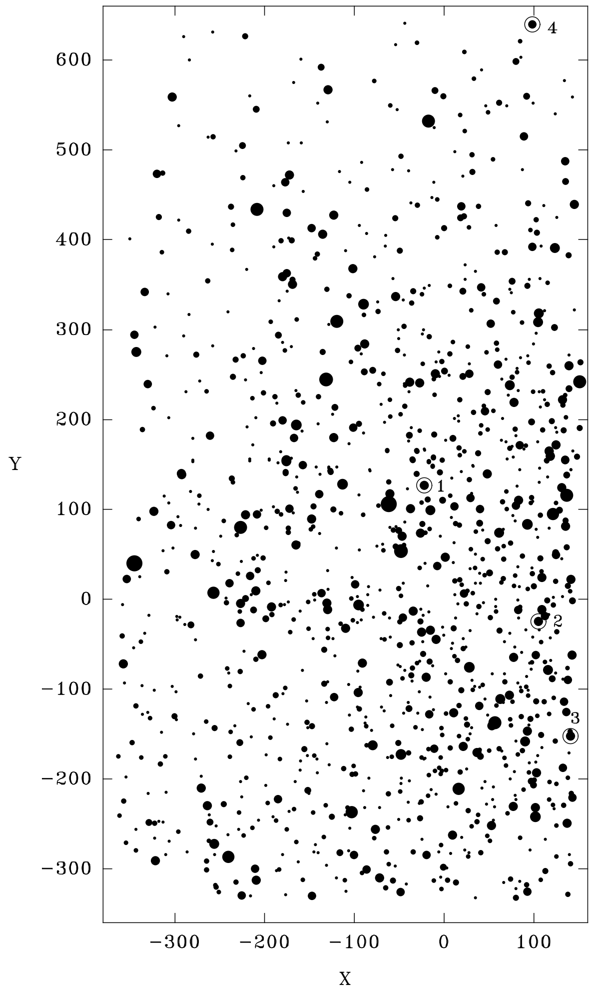

Figure 2. Chart of the western part of the cluster. Variable stars are denoted by ◯

Table 1. Positions and photometric data for suspected variables stars

N	X (arcsec)	Y (arcsec)	V	B−V
1	−76.06	33.38	16.13	0.66
2	−20.97	−46.72	15.77	0.62
3	−7.17	−98.01	15.87	0.59
4	−6.15	268.59	15.69	0.63

A comparison of the CMDs for the four fields revealed that the absorption in the southern part of the investigated area is less than in the northern part, E(B−V) = 0.1. The resulting CMD corrected for differential absorption is shown in Figure 1. Data for the four stars in the instability strip, which are suspected RR Lyr variables, are given in Table 1. Their positions are determined using as a reference frame the coordinate system given in the paper by Kaluzny & Krzeminski (1993) and are shown in the finding chart (Figure 2). V and $B-V$ values for V4 are corrected for differential absorption. The short duration of the observations, less than 35 min in each color for each field, did not permit the confirmation of the variability of these stars.

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IDENTIFICATION OF DAHLMARK VARIABLES: I

The amateur observer Lennart Dahlmark has published a useful series of IBVS notes listing a number of candidate variable stars, most of which were new. Although adequate charts and reliable semi-accurate positions were supplied, no other identifications were usually given. If the stars are to be recovered for further study and linkage within other surveys (IRAS, etc.), then precise positions must be determined to make identification unambiguous within crowded galactic fields.

Table 1 gives precise positions and identifications for the first list of variables published by Dahlmark (1982). The variable stars were identified independently by the two authors. Skiff compared Dahlmark's charts against the Digitized Sky Survey (DSS) using the Goddard SkyView facility (Scollick, 1995). The identifications were found within SIMBAD (for the GSC) and in the U.S. Naval Observatory's UJ1.0 and A0.9 star catalogues (Monet *et al.*, 1994; Monet *et al.*, 1996). Williams compared Dahlmark's charts against the DSS, maintained as a service at the Center for Astrophysics by the Computation Facility. Positions are taken either from the GSC or (preferably) from the USNO A1.0 (UA 1.0) catalogue. For those objects not found in these catalogues, positions were measured from the DSS, using 12–40 comparison stars from the UA 1.0 catalogue; the r.m.s. residuals of the comparison stars were under $0\farcs3$.

Table 1. Dahlmark Variables LD 8 – LD 65

Name	RA (2000)	Dec	s	IRAS	GSC	n	Other ids.
LD 8	19 50 39.58	+50 42 23.3	U	19492+5034			
LD 9	19 52 53.29	+46 21 45.8	G	19513+4613	3558-01549		
LD 10	19 53 47.98	+47 11 43.5	D		3562-01687	*	
LD 11	19 58 28.33	+47 06 10.4	D	19569+4657			
LD 12	19 59 11.98	+48 43 33.3	G	19577+4835	3562-00100		
LD 13	20 00 03.91	+41 00 44.7	U			*	
LD 14	20 03 45.61	+47 42 16.9	D			*	
LD 15	20 09 29.76	+47 57 02.1	G	20079+4748	3563-00128		
LD 16	20 10 20.32	+38 10 48.5	G		3151-02905		
LD 17	20 10 56.68	+40 58 21.1	U				
LD 18	20 11 29.58	+37 01 03.3	U				
LD 19	20 12 08.08	+39 36 49.7	G	20103+3927	3155-02205		V1633 Cyg
LD 20	20 17 17.15	+45 34 42.0	U		3572-00486		
LD 21	20 18 00.34	+43 43 54.9	U				
LD 22	20 20 24.97	+49 42 12.1	U				
LD 23	20 20 55.94	+50 27 29.1	G		3580-00223		V1774 Cyg

Table 1: Dahlmark Variables LD 8 – LD 65 (cont.)

Name	RA (2000)	Dec	s	IRAS	GSC	n	Other ids.
LD 24	20 34 06.09	+49 21 54.4	U	20325+4911			
LD 25	20 35 53.57	+42 58 26.1	G		3161-00327		
LD 26	20 36 57.08	+37 52 33.8	U	20350+3741			V1828 Cyg
LD 27	20 39 59.55	+49 57 49.0	U				
LD 28	20 42 24.57	+42 18 05.2	U			*	
LD 29	20 47 54.43	+45 41 27.0	D		3574-00339		
LD 30	20 48 13.95	+46 33 28.3	U				
LD 31	20 50 04.98	+37 29 59.6	U	20481+3718			V1864 Cyg
LD 32	20 52 27.87	+46 24 51.7	G		3575-04390		
LD 33	20 55 08.00	+38 37 43.7	U				
LD 34	20 57 53.62	+42 45 54.7	G		3175-00313		V1891 Cyg
LD 35	21 00 38.17	+38 38 32.2	D	20586+3826	3168-00004		
LD 36	21 03 04.03	+37 48 30.0	G	21011+3736	3168-00351		V1800 Cyg
LD 37	21 04 17.08	+37 51 06.6	G	21023+3739	3168-00575	*	
LD 38	21 06 33.13	+37 32 51.0	U		3168-00583	*	
LD 39	21 07 29.80	+37 10 44.7	G		2713-00439	*	V1804 Cyg
LD 40	21 07 39.51	+40 40 01.6	G		3172-01009		
LD 41	21 08 10.43	+37 28 16.4	U				
LD 42	21 09 44.00	+37 49 33.4	G		3168-02663		
LD 43	21 14 46.21	+44 17 45.0	G	21128+4404	3181-03797		V1554 Cyg
LD 44	21 15 06.92	+44 42 16.7	D	21132+4429	3181-01373		EM* CGHA 73
LD 45	21 17 17.59	+50 45 10.4	U	21156+5032	3601-00623		
LD 46	21 18 50.64	+39 54 13.2	U				
LD 47	21 19 41.11	+50 40 42.3	U				
LD 48	21 19 45.03	+49 41 59.0	G	21180+4929	3597-01643		EM* VES 391
LD 49	21 21 00.26	+38 13 50.9	G		3182-00035		V1903 Cyg
LD 50	21 23 41.39	+48 11 15.9	D	21219+4758	3594-00490		
LD 51	21 27 29.74	+39 17 11.0	U				
LD 52	21 28 44.83	+38 00 13.8	D		3182-04181	*	V1724 Cyg
LD 53	21 30 45.44	+43 31 58.4	G	21288+4318	3195-01178		V1566 Cyg
LD 54	21 30 49.90	+43 30 15.3	D		3195-01686	*	
LD 55	21 31 15.00	+38 46 32.1	U	21292+3833			
LD 56	21 31 28.58	+40 58 30.9	U	21294+4045		*	V1614 Cyg
LD 57	21 32 31.98	+38 57 54.8	G		3183-01551		V1910 Cyg
LD 58	21 32 50.27	+39 22 08.2	U	21308+3908			
LD 59	21 33 21.47	+38 02 45.6	U			*	V1615 Cyg
LD 60	21 36 21.64	+38 23 23.6	G		3183-01717		
LD 61	21 38 31.79	+45 42 46.7	U	21366+4529			V1568 Cyg
LD 62	21 39 40.62	+43 18 20.4	U	21377+4304			
LD 63	21 42 36.55	+44 56 36.1	G	21406+4442	3196-02133		V1571 Cyg
LD 64	21 43 19.47	+50 39 14.3	U	21415+5025			V1734 Cyg
LD 65	21 43 33.64	+49 08 58.3	G	21417+4855	3599-02290		CGCS 5431

Notes:

LD 10 Not visible on POSS-I O print, and R ∼17 on E print. GSC plate taken when V ∼15, blended with companion star to N with position end-figures $47^{\rm s}\!.84/49''\!.9$ (D).
LD 13 SE of two stars.
LD 14 Not IRAS 20021+4733.
LD 28 The brighter of two stars on DSS.
LD 37 Spectral type M5/7 (Dolidze 1975).
LD 38 Spectral type M5/7 (Dolidze 1975).
LD 39 Spectral type M7 (Dolidze 1975).
LD 52 ID verified against chart in Bychkov (1977b); SW star of two.
LD 54 Very close pair blended in GSC. Position given is for brighter (on DSS) NW component. SE component has end figures $50^{\rm s}\!.10/14''\!.1$ (D).
LD 56 ID verified against chart in Bartunov (1977).
LD 59 ID verified against chart in Bychkov (1977a).

The table lists the 'LD' name followed by the J2000 position and its source, coded in the table and notes as follows: U = UA 1.0; G = GSC 1.1; D = measurement from DSS using UA 1.0 comparison stars. The next two columns give IRAS point-source and GSC designations. An asterisk in the next column indicates a note at the bottom of the table. The final column contains GCVS designations and other names from SIMBAD.

The authors thank the following for their indispensable assistance in completing this work: SIMBAD, maintained by the Centre de Données Astronomique, Strasbourg, France; and SkyView, maintained by Keith Scollick at Goddard Space Flight Center.

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IDENTIFICATION OF DAHLMARK VARIABLES: II

This note is a continuation of a series (Skiff & Williams, 1997) listing accurate coordinates and identifications for variable stars discovered by the amateur observer Lennart Dahlmark. This work is intended to assist in the recovery of these variable stars for further study and linkage within other surveys.

The methods used by the authors in their independent identification of the variable stars are described in the first note of this series (Skiff & Williams 1997). Table 1 gives precise positions and identifications for the second list of variables published by Dahlmark (1986). The table lists the 'LD' name followed by the J2000 position and its source, coded in the table and notes as follows: U = UA 1.0; G = GSC 1.1; D = measurement from DSS using UA 1.0 comparison stars. The next two columns give IRAS point-source and GSC designations. An asterisk in the next column indicates a note at the bottom of the table. The final column contains GCVS designations and other names from SIMBAD.

Table 1. Dahlmark Variables LD 66 – LD 105

Name	RA (2000)	Dec	s	IRAS	GSC	n	Other ids.
LD 66	23 50 57.57	+64 55 39.3	U			*	
LD 67	23 59 10.99	+62 03 48.0	D			*	
LD 68	00 02 13.22	+64 54 23.8	U			*	V485 Cas
LD 69	00 02 10.32	+58 05 50.3	G		3660-00090		
LD 70	00 03 26.01	+67 08 30.6	U				
LD 71	00 03 41.97	+59 44 13.0	U				CGCS 5984
LD 72	00 04 07.08	+60 48 52.1	G	00015+6032	4014-02654		
LD 73	00 04 20.94	+65 19 51.1	U				
LD 74	00 07 05.59	+61 48 55.2	G	00044+6132	4014-00314	*	V658 Cas
LD 75	00 07 25.36	+63 20 57.2	G		4018-02473		
LD 76	00 07 34.75	+64 43 21.8	D	00049+6426			CGCS 8
LD 77	00 08 17.81	+52 45 57.1	U	00056+5229			
LD 78	00 11 13.59	+64 19 31.6	U	00085+6402			
LD 79	00 16 36.46	+66 01 10.6	G	00138+6544	4026-00479		
LD 80	00 16 54.52	+58 19 00.0	D			*	
LD 81	00 17 56.32	+59 09 15.1	U	00152+5852		*	V659 Cas
LD 82	00 19 59.34	+56 35 38.5	U				
LD 83	00 27 29.08	+59 19 47.7	G	00247+5903	3666-00491		
LD 84	00 34 26.50	+64 32 52.3	G	00315+6416	4024-01176	*	V660 Cas
LD 85	00 35 14.57	+52 53 31.5	D	00324+5236			
LD 86	00 35 41.13	+64 09 07.7	G	00327+6352	4024-01962		
LD 87	00 49 47.18	+66 27 12.5	U				
LD 88	00 51 04.15	+58 36 26.0	G	00481+5820	3667-01264		

Table 1 (cont.)

Name	RA (2000)	Dec	s	IRAS	GSC	n	Other ids.
LD 89	00 53 25.23	+65 01 56.4	D	00503+6445	4025-00239	*	
LD 90	00 56 33.06	+59 39 44.4	D	00535+5923			CGCS 142
LD 91	00 56 49.11	+67 15 14.2	G		4029-00984		
LD 92	00 57 18.55	+67 20 28.7	G	00540+6704	4029-00904		
LD 93	00 59 09.15	+63 48 50.1	G	00560+6332	4025-01404		CGCS 149
LD 94	00 59 24.12	+60 44 20.6	G	00563+6028	4017-01463	*	
LD 95	01 14 05.50	+56 20 39.8	G	01110+5604	3677-01412	*	
LD 96	01 14 53.61	+63 36 44.1	G	01116+6320	4034-00172		
LD 97	01 18 56.39	+53 27 44.4	U	01158+5312			
LD 98	01 20 18.17	+64 28 07.0	D	01169+6412	4038-01343	*	
LD 99	01 34 04.31	+62 11 47.3	U				
LD 100	01 43 16.73	+59 59 51.6	G		3683-00393		
LD 101	01 56 32.54	+59 56 29.9	D	01530+5941		*	
LD 102	02 00 57.12	+58 36 58.2	G	01574+5822	3697-02306	*	
LD 103	02 01 28.16	+58 18 14.2	G	01580+5803	3697-00241		V666 Cas
LD 104	02 02 46.54	+63 02 11.7	G		4037-01998		
LD 105	02 30 27.53	+62 31 45.8	G	02266+6218	4050-00898		V647 Cas

Notes:

LD 66 Published declination in error by $-4°$. Corrected following correspondence with Dahlmark.

LD 67 Close pair. Position given is for the brighter (on the DSS) component. Other component has end-figures $10^{s}.82/44''.2$.

LD 68 Spectral type M6: (Dolidze 1975).

LD 74 Spectral type M5/7 (Dolidze 1975).

LD 80 Close pair. Position given is for NE component. SW component (GSC 3665-01942) has end-figures $53^{s}.76/18'\ 49''.2$ (D).

LD 81 Spectral type M5/7 (Dolidze 1975).

LD 84 Spectral type M3/5SC (Dolidze 1975).

LD 89 Pair blended in GSC. Position given is for the brighter (on the DSS) component. Other component has end-figures $24^{s}.48/02'\ 01''.0$ (D).

LD 94 Not AV Cas: *cf.* remarks by Stephenson (1992).

LD 95 Not a blue star, as indicated by LD color.

LD 98 Pair blended in GSC. Position given is for the brighter (on the DSS) component. Other component has end-figures $18^{s}.68/27'\ 59''.9$ (D).

LD 101 Very close pair. Position given is S component. Other component has end-figures $32^{s}.57/32''.9$ (D).

LD 102 Spectral type M7 (Rust 1938).

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IDENTIFICATION OF DAHLMARK VARIABLES: III

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The methods used by the authors in their independent identification of the variable stars are described in the first note of this series (Skiff & Williams, 1997a). Table 1 gives precise positions and identifications for the third list of variables published by Dahlmark (1993, 1994). The table lists the 'LD' name followed by the J2000 position and its source, coded in the table and notes as follows: U = UA 1.0; G = GSC 1.1; D = measurement from DSS using UA 1.0 comparison stars. The next two columns give IRAS point-source and GSC designations. An asterisk in the next column indicates a note at the bottom of the table. The final column contains GCVS designations and other names from SIMBAD.

Table 1: Dahlmark Variables LD 106 – LD 185

Name	RA (2000)	Dec	s	IRAS	GSC	n	Other ids.
LD 106	19 03 12.86	+33 58 12.2	U	19013+3353			V494 Lyr
LD 107	19 06 18.09	+25 34 20.6	U	19042+2529			V337 Vul
LD 108	19 07 17.23	+31 42 54.5	G	19054+3138	2640-02384		V495 Lyr
LD 109	19 07 27.11	+35 46 35.3	U				V496 Lyr
LD 110	19 07 49.12	+36 23 09.1	G		2652-01471		V497 Lyr
LD 111	19 09 02.86	+32 53 22.5	G	19071+3248	2644-01985		V498 Lyr
LD 112	19 10 13.67	+23 20 39.1	D	19081+2315	2123-01515		V338 Vul
LD 113	19 11 13.16	+24 44 09.9	U				V339 Vul
LD 114	19 12 42.67	+23 11 26.0	G	19105+2306	2123-01937		V340 Vul
LD 115	19 13 19.64	+26 59 03.4	U				V500 Lyr
LD 116	19 14 37.54	+37 01 16.7	U	19128+3655			V501 Lyr
LD 117	19 22 00.87	+23 06 25.1	U	19199+2300			V342 Vul
LD 118	19 22 01.94	+26 22 22.4	G	19199+2616	2132-02539		V343 Vul
LD 119	19 22 41.15	+25 58 37.7	U				V344 Vul
LD 120	19 23 14.14	+24 27 40.1	G	19211+2421	2128-00676		V335 Vul
LD 121	19 23 48.69	+26 27 21.2	U	19217+2621			V345 Vul
LD 122	19 24 22.65	+32 19 08.2	D	19224+3213			V503 Lyr
LD 123	19 25 55.76	+26 38 23.8	U	19238+2632			V346 Vul
LD 124	19 26 01.95	+35 03 08.0	U	19241+3457			V504 Lyr
LD 125	19 27 06.35	+35 23 44.1	G		2662-02213		V1985 Cyg
LD 126	19 27 45.90	+24 42 34.5	U				V347 Vul
LD 127	19 30 14.60	+28 09 40.3	U	19282+2803			V1986 Cyg

Table 1 (cont.)

Name	RA (2000)	Dec	s	IRAS	GSC	n	Other ids.
LD 128	19 31 10.48	+23 30 33.9	G	19290+2324	2125-00932	*	V349 Vul
LD 129	19 31 42.89	+28 50 39.5	U				V1987 Cyg
LD 130	19 35 50.75	+34 16 10.2	U				V1988 Cyg
LD 131	19 39 20.48	+23 44 20.2	U	19372+2337			V350 Vul
LD 132	19 40 20.16	+23 32 58.2	D	19382+2325			V351 Vul
LD 133	19 41 02.38	+24 52 35.0	G	19389+2445	2143-01826		V352 Vul
LD 134	19 42 09.89	+30 13 52.8	U				V1989 Cyg
LD 135	19 43 33.47	+34 29 23.9	G	19416+3422	2664-00331	*	V1990 Cyg
LD 136	19 43 51.80	+32 29 28.8	D	19419+3222		*	V1991 Cyg
LD 137	19 46 25.04	+31 40 08.1	U	19444+3132			V1992 Cyg
LD 138	19 46 47.37	+28 08 33.4	G	19447+2801	2151-05679		AI Vul
LD 139	19 47 19.87	+35 46 18.9	U				V1993 Cyg
LD 140	19 49 22.13	+22 37 40.8	U	19472+2230			V353 Vul
LD 141	19 49 13.18	+29 31 36.6	D	19472+2923	2152-00824	*	V1995 Cyg
LD 142	19 49 48.70	+35 49 14.4	U	19479+3541			V1000 Cyg
LD 143	19 50 10.47	+22 32 17.0	U	19479+2224			V354 Vul
LD 144	19 50 11.22	+26 26 51.9	U				
LD 145	19 51 15.10	+26 10 56.6	U				V355 Vul
LD 146	19 51 28.78	+32 47 44.4	U	19495+3239			V1997 Cyg
LD 147	19 52 01.82	+27 09 44.9	U	19499+2701			V356 Vul
LD 148	19 53 57.19	+23 08 24.5	U				V357 Vul
LD 149	19 55 12.42	+22 31 06.6	D	19530+2223	2140-02164	*	V358 Vul
LD 150	19 55 57.13	+22 21 00.1	D	19537+2212		*	V359 Vul
LD 151	19 56 28.25	+23 16 13.4	U	19543+2308			V360 Vul
LD 152	19 58 01.52	+31 54 38.4	D	19560+3146			V2001 Cyg
LD 153	19 58 13.89	+29 41 30.1	U	19562+2933			V2002 Cyg
LD 154	19 59 06.57	+31 13 31.7	G		2670-02068		V2003 Cyg
LD 155	20 02 29.72	+29 51 40.8	D	20004+2943			V2004 Cyg
LD 156	20 03 10.58	+31 24 17.6	D		2670-02272		V2005 Cyg
LD 157	20 03 24.02	+29 54 53.4	G	20013+2946	2153-00130		V2006 Cyg
LD 158	20 06 20.26	+25 27 26.2	U				V363 Vul
LD 159	20 06 15.45	+35 17 24.6	D	20043+3508		*	V2007 Cyg
LD 160	20 06 38.33	+33 58 07.6	U	20047+3349			V2009 Cyg
LD 161	20 08 26.67	+25 35 50.5	U	20063+2527			V364 Vul
LD 162	20 09 44.16	+31 58 49.2	U				V2010 Cyg
LD 163	20 10 01.08	+25 37 59.7	U	20079+2529			V365 Vul
LD 164	20 11 00.24	+22 51 43.1	U			*	HX Vul
LD 165	20 12 37.94	+24 36 47.8	G	20104+2427	2158-01697		V366 Vul
LD 166	20 15 40.50	+25 26 38.4	U	20135+2517			V367 Vul
LD 167	20 16 05.74	+24 13 38.6	U	20139+2404			V368 Vul
LD 168	20 21 31.29	+30 24 48.1	U	20194+3015			V2013 Cyg
LD 169	20 21 34.58	+29 14 46.8	U	20195+2905			V372 Vul
LD 170	20 22 09.93	+22 22 59.4	U				V373 Vul

Table 1 (cont.)

Name	RA (2000)	Dec	s	IRAS	GSC	n	Other ids.
LD 171	20 26 08.76	+28 09 39.2	U	20240+2759			V374 Vul
LD 172	20 27 28.33	+24 17 21.7	D	20253+2407			V375 Vul
LD 173	19 17 46.37	+34 26 01.2	U				V502 Lyr
LD 174	19 21 45.16	+24 43 17.9	U	19196+2437			V341 Vul
LD 175	19 30 15.02	+24 10 10.6	U				V348 Vul
LD 176	19 48 32.50	+32 06 03.6	U				V1994 Cyg
LD 177	19 50 45.14	+29 29 10.1	D	19487+2921	2152-00122	*	V1996 Cyg
LD 178	19 52 21.95	+30 50 15.3	D	19503+3042			V1998 Cyg
LD 179	19 54 23.40	+34 04 51.3	U	19524+3356			V1999 Cyg
LD 180	19 56 08.54	+35 30 40.6	U	19542+3522			V1460 Cyg
LD 181	19 57 29.26	+30 43 13.4	D	19554+3035			V2000 Cyg
LD 182	19 58 02.99	+22 49 29.9	U	19558+2241			V361 Vul
LD 183	19 58 14.84	+35 43 22.0	G		2682-01684		V1464 Cyg
LD 184	20 18 22.86	+26 39 15.6	D	20162+2629		*	V369 Vul
LD 185	20 18 38.03	+28 35 28.1	U				V370 Vul

Notes:

LD 128 IRC +20412.
LD 135 CGCS 4443.
LD 136 CGCS 4445.
LD 141 CGCS 4500. Not EM* VES 61. Close trio blended in GSC. Other components have end-figures $12^{\rm s}.89/33''.1$ (D) and $12^{\rm s}.90/29''.7$ (D).
LD 149 Pair. GSC entry flagged as 'nonstellar'. N component has end-figures $12^{\rm s}.23/13''.8$ (U).
LD 150 CGCS 4561. Pair. N component has end figures $57^{\rm s}.13/06''.5$ (D).
LD 159 CGCS 4670.
LD 164 Identity confirmed by comparison with finder chart on *MVS* 286.
LD 177 Pair blended in GSC. N component has end-figures $45^{\rm s}.03/15''.6$ (D).
LD 184 Pair. E component has end-figures $23^{\rm s}.08/17''.8$ (D).

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IDENTIFICATION OF DAHLMARK VARIABLES: IV

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The methods used by the authors in their independent identification of the variable stars are described in the first note of this series (Skiff & Williams, 1997a). Table 1 gives precise positions and identifications for the fourth list of variables published by Dahlmark (1994, 1996). The table lists the 'LD' name followed by the J2000 position and its source, coded in the table and notes as follows: U = UA 1.0; G = GSC 1.1; D = measurement from DSS using UA 1.0 comparison stars. The next two columns give IRAS point-source and GSC designations. An asterisk in the next column indicates a note at the bottom of the table. The final column contains GCVS designations and other names from SIMBAD.

Table 1. Dahlmark Variables LD 186 – LD 220

Name	RA (2000)	Dec	s	IRAS	GSC	n	Other ids.
LD 186	21 53 29.32	+44 05 05.0	G		3197-00543		V1093 Cyg
LD 187	21 57 32.02	+38 24 25.0	U				
LD 188	21 58 53.70	+50 12 01.2	U	21570+4957			
LD 189	22 06 32.94	+48 07 28.1	U				
LD 190	22 07 54.22	+41 05 11.4	U	22057+4050			
LD 191	22 09 05.10	+45 30 28.7	G	22070+4515	3606-00442		
LD 192	22 09 30.89	+52 11 30.1	G		3618-02113		
LD 193	22 09 34.88	+52 12 30.4	D		3618-00137	*	
LD 194	22 10 15.66	+38 15 45.7	U	22081+3801			FBS L 1-19
LD 195	22 13 50.01	+43 54 38.2	G		3211-01072		
LD 196	22 14 46.86	+46 54 39.2	U				
LD 197	22 15 58.94	+42 22 46.4	U	22138+4207			
LD 198	22 19 38.18	+48 13 20.3	U	22175+4757			
LD 199	22 23 28.93	+47 44 32.2	U				NSV 14144
LD 200	22 24 49.89	+47 49 24.1	U				
LD 201	22 25 41.15	+50 18 16.1	D	22236+5002		*	
LD 202	22 26 22.70	+48 24 05.2	U				
LD 203	22 28 13.09	+44 27 51.9	G		3212-00933		
LD 204	22 29 56.56	+45 46 54.8	U				
LD 205	22 31 34.45	+48 16 00.7	G	22294+4800	3624-01959		
LD 206	22 41 10.49	+40 34 10.4	U				
LD 207	22 43 21.04	+41 17 20.1	G	22410+4101	3222-00149	*	
LD 208	22 45 15.09	+50 51 53.9	U	22431+5036			HL Lac

Table 1 (cont.)

Name	RA (2000)	Dec	s	IRAS	GSC	n	Other ids.
LD 209	22 46 20.97	+52 14 34.6	G		3633-02601	*	
LD 210	22 49 35.45	+52 18 11.0	G	22474+5202	3633-02259		
LD 211	22 50 15.93	+53 24 17.0	U	22481+5308			
LD 212	22 59 06.46	+49 07 58.2	D				
LD 213	23 01 06.42	+37 50 45.3	G		3216-01210		
LD 214	23 02 02.40	+39 59 50.8	G	22597+3943	3220-02872		
LD 215	23 02 24.03	+41 43 36.9	G		3224-01028	*	
LD 216	23 06 24.50	+38 15 34.4	D	23040+3759	3216-02107	*	
LD 217	23 16 25.96	+38 43 47.1	U	23140+3827			
LD 218	23 25 41.71	+45 42 03.9	U	23233+4525			
LD 219	23 31 01.32	+50 03 17.6	U	23286+4946			
LD 220	23 34 07.64	+46 20 02.9	U	23317+4603		*	NSV 14621

Notes:

LD 193 NE component of very close pair blended in GSC. SE component has end-figures $35^{\rm s}.16/28''.3$ (D).
LD 201 NE component of pair. SW component has end-figures $40^{\rm s}.73/12''.0$ (D).
LD 207 Spectral type M7 (Dolidze 1975)
LD 209 Not FK Lac, see Williams (1996).
LD 215 Faint on POSS-I red print (R $\sim$ 16–17), bright in GSC.
LD 216 SW component of pair blended in GSC. NE component has end-figures $24^{\rm s}.87/37''.7$ (D).
LD 220 SV* R 101.

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CCD PHOTOMETRY OF ECLIPSING BINARY AL OPHIUCHI

The eclipsing binary AL Ophiuchi (= GSC 0999.155; $\alpha(2000) = 17^{\mathrm{h}}26^{\mathrm{m}}45\overset{\mathrm{s}}{.}4$, $\delta(2000) = +12^\circ57'56''$) is a neglected, rather faint binary near α Oph. Its V magnitude given in the *Guide Star Catalogue* is $13\overset{\mathrm{m}}{.}05$. Unfortunately, this variable has not been studied photometrically for more than 20 years and the light elements of this system are not given in the GCVS.

Variability of this star with amplitude 14.1 – 15.0 mag was discovered photographically by Reinmuth (1926) in Heidelberg. The spectral type of AL Oph was measured by Bond and Tifft (1974) during their spectroscopic survey of some high-latitude blue variables. They found a spectrum of G5. Meinunger (1981) concluded that AL Oph belongs to the W UMa type and the amplitude is too small for the period determination from the older photographic measurements. Recently, the variability of AL Oph was examined on the plates of the Odessa Observatory by V.I. Marsakova (Andronov 1996) and several weakenings were obtained. This star was also measured by Paschke (1996). All previous measurements lead to uncertain conclusions about its type and light elements.

The present CCD photometry of AL Oph was carried out during 14 nights in the period from June to November 1996 at the Ondřejov Observatory, Czech Republic, using a 65cm reflecting telescope with a CCD-camera (SBIG ST-6) in the primary focus. The measurements were done using the standard Cousins R filter with exposure time from 45 to 120 s. Two nearby stars GSC 0999.1235 ($V = 11.6$ mag) and GSC 0999.388 ($V = 12.8$ mag) on the same frame as AL Oph served as a comparison and check stars (Figure 1). Some of the observations were done through thin clouds. The CCD data were reduced using software developed by P. Pravec and M. Velen (Pravec et al. 1994). No correction of relative magnitudes was allowed for airmass due to the proximity of the comparison star to the variable (46 arcsec). Deviations caused by differential extinction in the broad-band filter for different colours of stars should not be significant. Due to preliminary period close to one sidereal day, the primary minima were observable only before the end of June 1996. On August 25 we obtained a flat secondary minimum and, fortunately, in November 21 LŠ observed a part of the descending branch to the primary minimum.

The times of minimum and period were determined using a new method of iterative least squares polynomial fitting. The method for a minimum determination was developed especially for processing of precise lightcurves with partial coverage of both branches. This is a typical result of non-automatical CCD observations, when several objects are followed and for a particular object we obtain groups of consequent images separated by large time intervals. This method should provide also more reliable results in the case when the number of points on each branch differs. We suppose only the symmetry of the minimum.

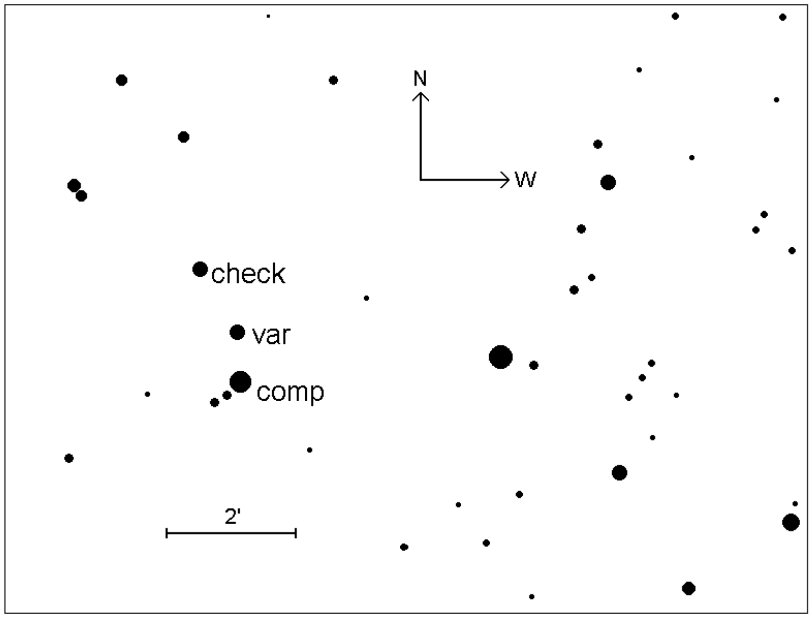

Figure 1. Finding chart of AL Oph. The comparison and check stars are also plotted

Table 1. New times of minimum of AL Oph

JD Hel.− 24 00000	Error [days]	Min. type	$O-C$ [days]	Epoch	N
50250.3865	0.0004	Pri.	+0.0006	7.0	16
50252.3717	0.0003	Pri.	–0.0002	9.0	25
50321.3896	0.0009	Sec.	+0.0038	78.5	65

Similar way of solution – double iteration connected with the least squares fitting – can be used for determination of light elements from several night observation. We choose a symmetrical feature on the lightcurve (primary minimum), estimate period and basic light minimum. Then we fit a low-order polynomial like in the case of simple minimum determination. Varying the period we find a minimum residual corresponding to the best period. Using this method we can determine the precise value of period in the case of AL Oph, where we have only two primary minima with low accuracy in a short time interval (see Table 1). We derived the following linear light elements for the current use:

$$\text{Pri.Min.} = \text{HJD } 24\ 50243.4348 + 0\overset{d}{.}993005 \times \text{E.}$$
$$\pm 0.0003 \pm 0.000025$$

Observed times of minima are presented in Table 1. In this table, N stands for the number of observations used in the calculation of the minimum time, the other symbols are self-explanatory. Figure 2 shows the composite differential R light curve during the summer 1996. The light amplitude in R colour for primary minimum according to our measurement is $A_1 = 0.56 \pm 0.02$ mag, for secondary minimum we found $A_2 = 0.10 \pm 0.02$ mag. The duration of both minima seems to be about 2 hours. New measurements of this system are necessary to improve the above given elements.

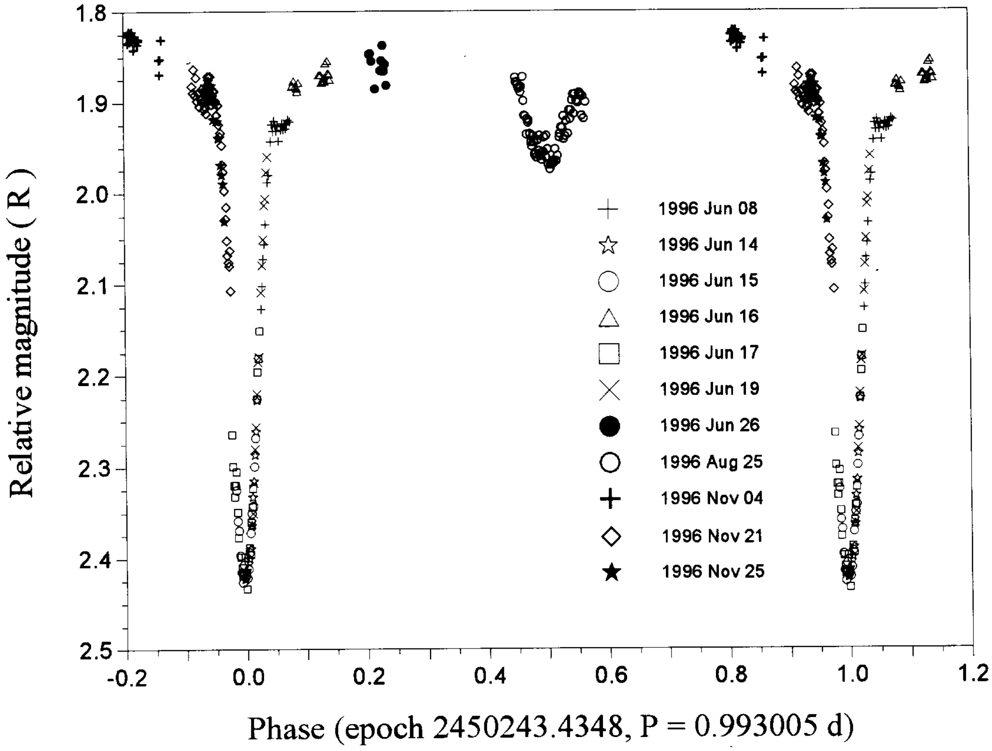

Figure 2. Composite differential R-light curve of AL Oph obtained in 1996

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HR 7674: A LOW-AMPLITUDE CEPHEID?

HD 190422 = HR 7674 ($\alpha_{2000} = 20^{\mathrm{h}}07^{\mathrm{m}}35^{\mathrm{s}}$, $\delta_{2000} = -55°01\overset{'}{.}0$,V = 6.25) was chosen as a comparison star for a study of photometric variations of some Ap stars, the results of which will be published elsewhere. The observations have been made at La Silla (ESO) during a three-week run in August 1996 with the 70 cm Swiss telescope equipped with the seven-colour double-beam Geneva photometer. Since HD 190422 was a comparison star for our initial programme, we could not use differential measurements. We had to rely on absolute data. Fortunately, these are of high quality in the Geneva system at La Silla.

This bright star is neither in the GCVS nor in the NSVSC. It is a standard of the Geneva system and does not appear in Rufener & Bartholdi's (1982) list of suspected variables. Neither is it suspected in variability in the Hipparcos Input Catalogue (Turon et al., 1992). Hence we were somewhat surprised to find HR 7674 to be slightly variable.

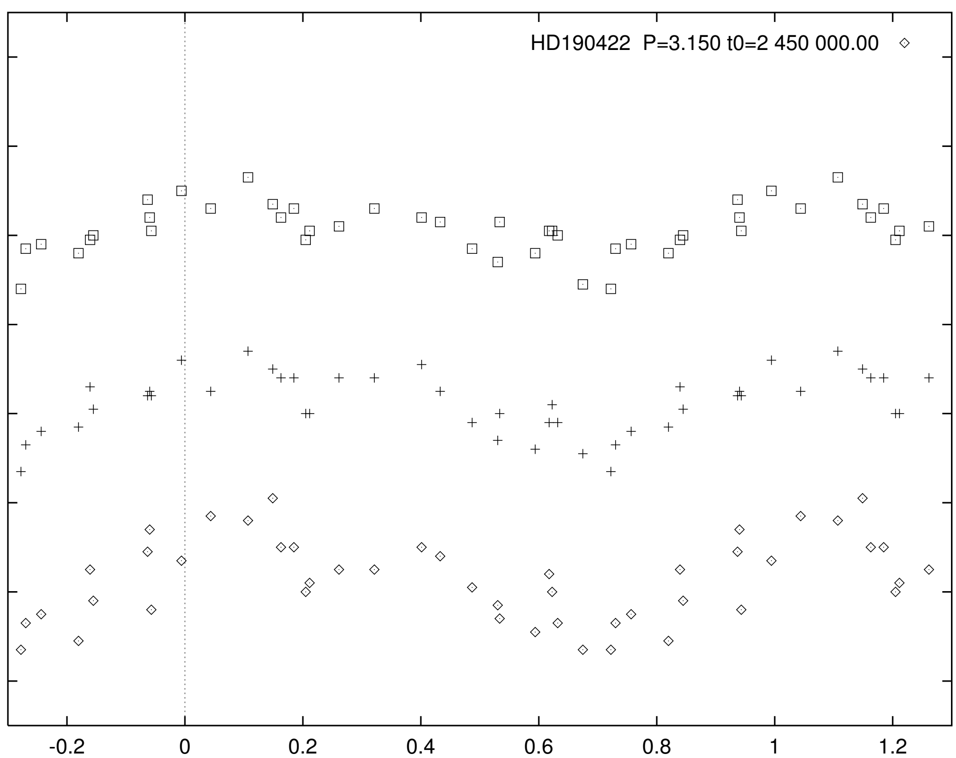

Figure 1. Lightcurves of HD 190422 in Geneva's UBV (bottom to top). The phase on the horizontal axis is computed with the origin JD=2 450 000. Tick marks on the vertical axis are separated by $0\overset{\mathrm{m}}{.}002$

Renson's (1978, 1980) period-searching algorithm has been applied to the 29 measurements obtained for this star. The resulting period is P = $3^{\mathrm{d}}.15 \pm 0^{\mathrm{d}}.03$. Figure 1 shows the measured Geneva V, B and U magnitudes plotted vs phases calculated with this value of P and the time origin 2 450 000.0. The total amplitude has been estimated by fitting a smooth analytical curve through the observations. It is about $0^{\mathrm{m}}.014$, $0^{\mathrm{m}}.016$ and $0^{\mathrm{m}}.023$ in V, B and U, respectively. All colours vary in phase with a rapid brightening followed by a slower fading. The maximum brightness is reached around phase 0.05 and the minimum at 0.70.

The HD spectral type of the star is F8, which is in perfect agreement with Johnson's colour index $B-V = 0.53$. An MK type F8V has also been published (Buscombe, 1977).

The asymmetric shape of the variation, the colour dependence of the amplitude and the synchronism of the light curves in all colours point toward HR 7674 being a low-amplitude cepheid. On the other hand, the luminosity class V disagrees with a cepheid nature of the star.

A confirmation of the origin of the variations would be obtained by a radial-velocity analysis. Because of the small amplitude, a high accuracy is needed. This is probably difficult to achieve because of the large value of $v \sin i$ (200 km/s).

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PHOTOELECTRIC OBSERVATIONS OF X PERSEI

X Persei (HD 24534) is the optical counterpart of X-ray transient source 4U 0352+30. The system consists of a neutron star secondary accreting from an O9.5IIIe primary via stellar wind processes. To investigate whether the last fading phase of X Persei beginning in 1990 is going on, we observed the system. The present observations were made in Johnson's UBV bands with the 30-cm Maksutov telescope of Ankara University Observatory. In the observations, BD+31°0655 was used as comparison star while BD+29°0632 and BD+30°0582 were chosen as the check stars. The magnitude differences between check stars and comparison star were constant within probable errors of ±0.026 in V band. The individual differential observations were corrected for atmospheric extinction and light time effect of Earth's motion, and the V band differential magnitude determinations were transformed to the standard system.

Since the end of 19th century X Persei has been known to be a variable on a long time-scale. Roche et al. (1993) presented the most comprehensive optical light curve over the period 1964-1992. During this period the Be star has undergone two extended faint, non-variable phases, seen in 1974-1977 and 1990-1992. After this study, Zamanov and Zamanova (1995) have observed X Persei in the period 1992-1994. Their data are shown as (+) in the figures and are evaluated together with our data. Their observations showed the optical low state that began in the mid-1990 finished in the spring of 1993. After this, the star has entered the optical high state. Our observations between 1994-1996 (see Table 1) indicate that the brightness of the system decreased again in 1995 and the star was still in a low state during our last observations in 1996 (Figure 1).

Figure 1 presents the V band light curve over the period 1991-1996. Our observations shown as open circles have completed the missing data in the vicinity of maximum after the 1990-1993 low state. The magnitude at maximum obtained at the end of October 1994 is found of 6.23 close to the values of the previous maxima. Also the current low state is similar to the previous ones ($V \approx 6.6-6.7$), and only the minimum in 1990-1993 is deeper than others ($V \approx 6.8$). If these minima are due to the loss of the Be star circumstellar disk, the current low phase must be associated with a new partial (or complete) disk-loss state.

The B$-$V and U$-$B colour changes are shown in Figures 2 and 3. Although the observed B$-$V and U$-$B colour index values show a large amount of scatter, it is seen that during the rapid brightening that followed the 1990-1993 low state, the B$-$V colour became redder as expected. At 1990-1993 low state the observed U$-$B index is between -0.65 and -0.7. This value is consistent with a B0 star which has a colour excess E(B$-$V)=0.39 given by Fabregat et al. (1992). During the stage of high luminosity the observed U$-$B increased to about -0.85 suggesting that the disk radiation contributes to the observed Balmer excess.

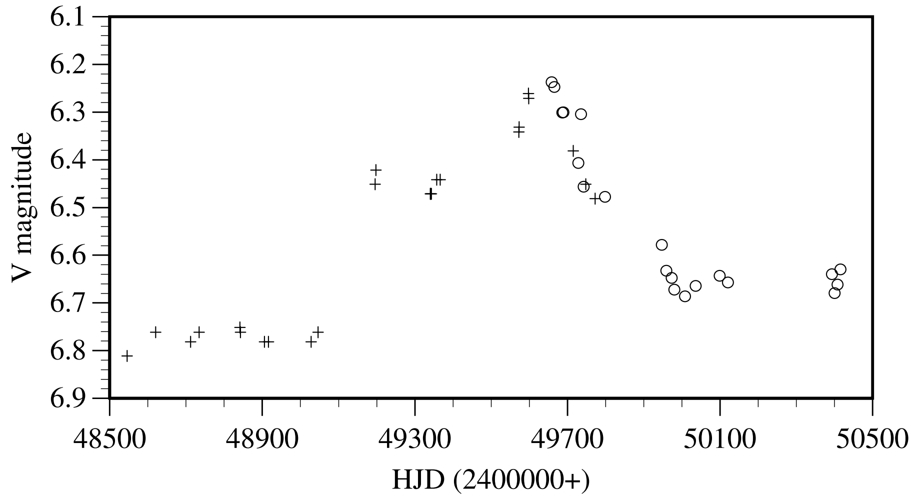

Figure 1. The long term V band light curve of X Persei

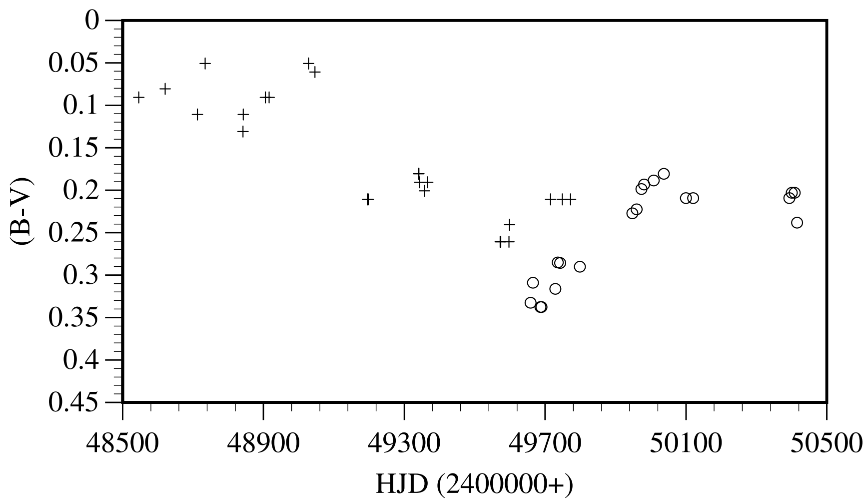

Figure 2. The B−V colour changes of X Persei over the past 4 years

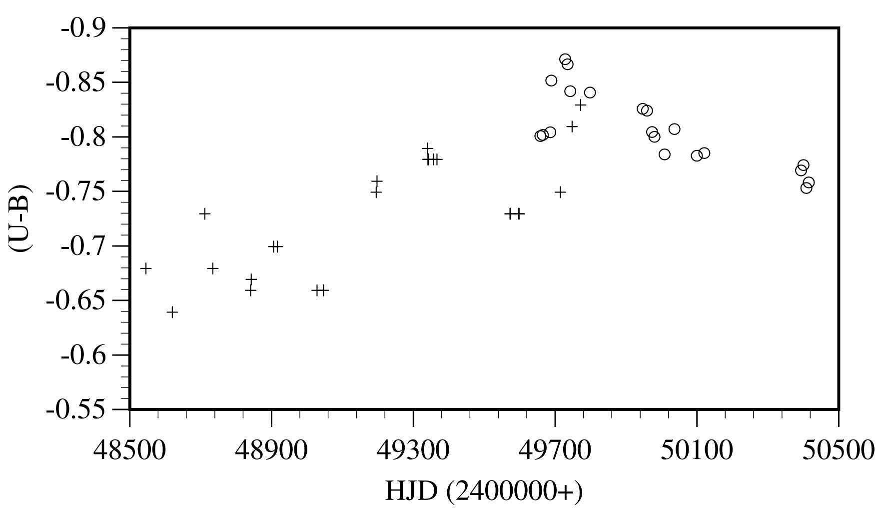

Figure 3. The U−B colour changes of X Persei over the past 4 years

HJD	V	B−V	U−B
2449655.4292	6.240	0.332	−0.801
2449662.3049	6.250	0.309	−0.802
2449683.3035	6.304	0.337	−0.805
2449686.2576	6.303	0.337	−0.852
2449725.2500	6.409	0.316	−0.872
2449732.1701	6.307	0.437	−0.867
2449739.1910	6.459	0.285	−0.842
2449795.2382	6.481	0.290	−0.841
2449943.5250	6.581	0.227	−0.826
2449956.4424	6.635	0.222	−0.824
2449970.4125	6.650	0.198	−0.805
2449977.4424	6.675	0.193	−0.800
2450005.5299	6.689	0.188	−0.784
2450033.3597	6.669	0.180	−0.808
2450096.3618	6.646	0.209	−0.783
2450117.2819	6.660	0.209	−0.786
2450390.3243	6.642	0.209	−0.770
2450397.4993	6.682	0.203	−0.775
2450404.5097	6.664	0.202	−0.754
2450411.5417	6.632	0.238	−0.759

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ORBITAL PERIOD OF THE ECLIPSING VARIABLE V1147 CYGNI

V1147 Cyg = HBV 426 was discovered by Wachmann (1966) who estimated the period as $238\overset{d}{.}02/n$. In the GCVS IV (Kholopov et al., 1985) another possible period $2\overset{d}{.}24460$: is listed. We have measured the star on 144 photographic plates of the Odessa Sky Patrol by using the comparison stars published by Wachmann (1966).

For the period search we have used 6 moments of most prominent weakenings: HJD 2434119.525, 34952.358 (Wachmann, 1966), 36462.3483 ($12\overset{m}{.}25$), 39741.3395 ($12\overset{m}{.}47$), 41150.3982 ($12\overset{m}{.}36$), 41544.3847 ($12\overset{m}{.}27$) (this paper).

We have used the fast algorithm and computer code described by Andronov (1991, 1994). The test function used is the r.m.s. deviation of $\phi + 0.5$ from 0.5, where ϕ is the phase of decreased brightness. The phase curves were plotted for 32 most prominent minima at the periodogram. This visual control allowed us to choose the value of the possible period corresponding to the 4-th (by periodogram value) minimum. The linear ephemeris for the moments of minima is

$$\begin{array}{rcl} MinHJD = 2439741.340 & + & 1.097382 \times E \\ \pm\ \ 2 & \pm & 6 \end{array} \qquad (1)$$

Besides visual analysis, we have computed the “slow” periodograms corresponding to the methods of Lafler and Kinman (1965) and Deeming (1970) by using the computer code written by I.L. Andronov. The optimal value of the period was found to be P=$1\overset{d}{.}097383$ for both methods. The accuracy estimate is better than 10^{-6} days, the value of the period shift for which the depth of the minimum at the periodogram decreases by ≈ 30 per cent. Naturally, smaller error estimate was obtained for the periodogram using all 144 observations instead of 6 moments of used in Eq. (1).

The light curve is shown in Figure 1. Outside eclipse the r.m.s. scatter, equal to $0\overset{m}{.}066$, is typical of photographic measurements. Mean value is $11\overset{m}{.}92$ is in excellent agreement with the value $11\overset{m}{.}9$ listed in GCVS. The amplitudes of the first and second harmonics do not exceed 1.5σ and thus are not statistically significant. The duration of the eclipse is 0.076P.

The scatter of photographic data may mask the secondary minimum at phase 0.5, the depth of which does not exceed $0\overset{m}{.}1$. As the depth of the primary minimum is $\approx 0\overset{m}{.}46$, this may argue for a cooler secondary. Another possibility is that the real period is twice larger than the value mentioned above. In this case the minima may be of comparable depths arguing for similar surface brightnesses of both stars. From the present data we cannot determine magnitudes at both minima with an accuracy needed to find difference between them. Comparing Wachmann's (1966) estimate $238\overset{d}{.}02/n$ with the period value computed in this work one may easily find that n=216.9. There is no contradiction, as Wachmann (1966) had used dim magnitudes instead of true minima, one of which was marked as unsure. Two sure minima were used to determine the period and are in excellent agreement with the given elements.

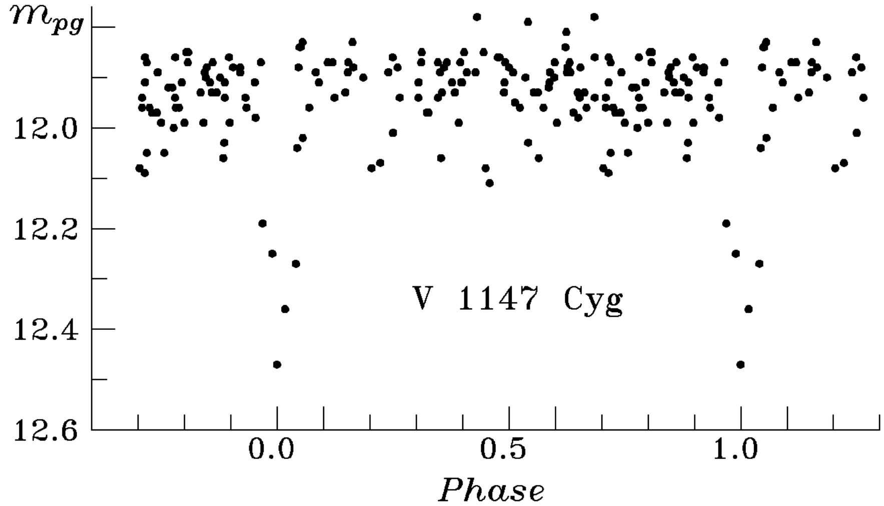

Figure 1. Photographic light curve of V1147 Cyg = HBV 426 computed according to the ephemeris $MinHJD = 2439741.340 + 1.097383 \times E$

Assuming the stars are of nearly spherical shape (from the EA classification), one may obtain the geometric inequality (e.g. Tsessevich, 1980) $(R_1 + R_2)/a \geq \sin(2\pi\phi) = 0.24$. Additionally assuming that both stars obey the main sequence mass-radius relation $R/R_\odot = R_*(M/M_\odot)$ with $R_* = 1.26$ (Allen, 1973), one may easily obtain another inequality

$$M_1 + M_2 \geq \frac{\sin^{3/2}\phi\,(GM_\odot)^{1/2}P}{2\pi(R_*R_\odot)^3/2} \tag{2}$$

where ϕ is the phase of the first contact, i.e. half-duration of the minimum. Equality holds for the inclination angle i=90°. For our data, one may estimate $(M_1 + M_2) \geq 0.384M_\odot$ for P=$1^{\mathrm{d}}.097382$ and $(M_1 + M_2) \geq 0.77M_\odot$ for the hypothesis of double period P=$2^{\mathrm{d}}.194764$.

To distinguish between these two periods, CCD or photoelectric photometry in at least two filters is needed.

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PHOTOELECTRIC VI_c OBSERVATIONS AND NEW ELEMENTS FOR V399 CARINAE = HR 4110

Arellano Ferro (1981) analyzed observations of V399 Car = HD 90772 = HR 4110, the brightest member — of spectral type A7 Ia-O (Turner 1978; see also references cited by Arellano Ferro 1981) — of the young cluster IC 2581, and found four possible periods in its power spectrum: 34.87, 40.26, 47.80, and 58.82 days. He noted that a period of 58.82 days provided the best match of his observations to those supplied by Madore (1980).

In an attempt to update the ephemeris for the star, we observed it at CTIO in September-November 1996 using the 1-m reflector. A total of 18 VI_c measurements were obtained, the accuracy of the individual data being near $\pm0\overset{m}{.}01$ in both filters. The observations are listed in Table 1.

The mean magnitudes of Arellano Ferro's (1981) as well as Cousins' (1966) observations were coincidenced with our V-band data in order to increase the sample available for a period search. We derived the following elements:

$$\text{Max JD}_{hel} = \underset{\pm 0.4}{2450387.4} + \underset{\pm 0.0027}{47.2534} \times \text{E}.$$

Those elements are used in Figure 1 for plotting the light curve in V, where our observations are identified by large circles and observations published by Arellano Ferro (1981) and Cousins (1966) are denoted by small circles and dots, respectively. The shorter period found here appears to be supported by the rapid change in brightness of the star detected over our observing season.

Table 1

JD_{hel} 2450000+	V	$V-I_c$	JD_{hel} 2450000+	V	$V-I_c$
358.8828	4.684	.680	383.8107	4.636	.681
359.8730	4.693	.680	384.7948	4.650	.691
361.8785	4.705	.689	386.7912	4.651	.674
362.8819	4.694	.674	387.7955	4.640	.680
362.8887	4.702	.688	388.7856	4.643	.690
363.8822	4.699	.697	390.7897	4.643	.689
379.8201	4.661	.667	391.7781	4.657	.676
380.8109	4.635	.663	392.7720	4.635	.679
381.8093	4.665	.685	393.7821	4.645	.684

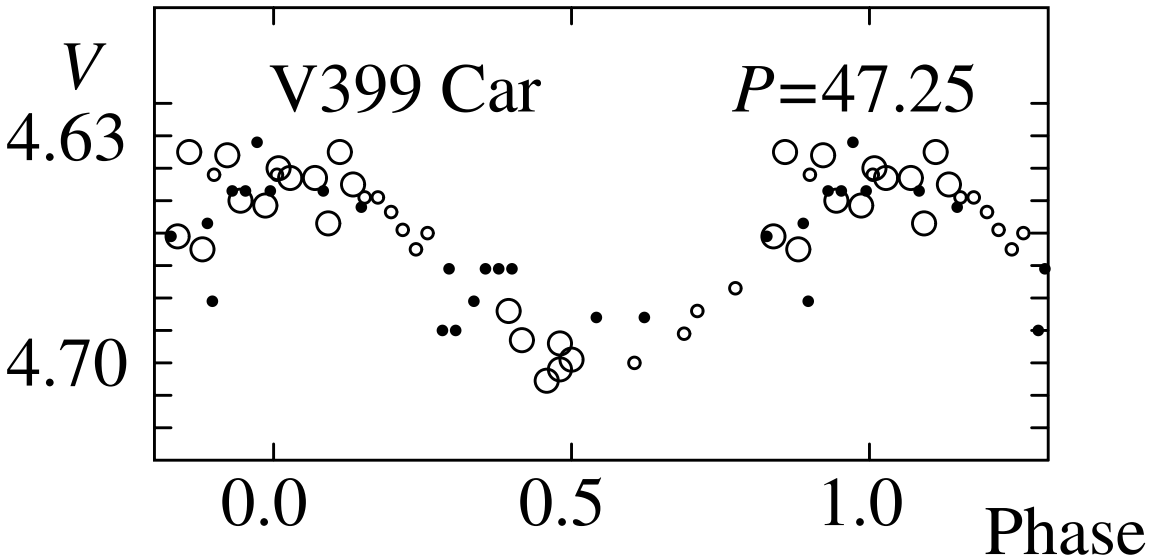

Figure 1

As a member of the cluster IC 2581, HR 4110 has an estimated luminosity of $M_V = -8.8$ (Turner 1978), placing it in the regime of the hypergiant stars. It is of interest to note that, at the period found here, HR 4110 falls almost exactly on the period-luminosity relation for pulsating B and A-type supergiants published several years ago by Maeder & Rufener (1974; see also Burki 1978).

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VARIABLE STARS IN THE GLOBULAR CLUSTER NGC 6266

M62 (NGC 6266, C1658-300) is located close to the galactic center ($l = 353^\circ\!.6$, $b = 7^\circ\!.3$). This rather metal rich cluster ([Fe/H] = −1.28 (Zinn & West, 1984)) belongs to the concentration class CC IV, its apparent radius is $r = 7'\!.1$ (Kukarkin, 1974) and the tidal radius $10'\!.5$ (Webbink, 1985). M62 is rich in variables: 89 variables were discovered in the cluster (Sawyer-Hogg, 1973), periods are defined for 74 of these stars. Twelve of them are classified as RRc and 66 as RRab variables. Values of P_{ab}, N_c/N_{ab} confirm the classification of the cluster as OoI variable rich one.

Table 1. Positions and photometric data for suspected variables

N	X_{SH} (arcsec)	Y_{SH} (arcsec)	ΔV	ΔB	N	X_{SH} (arcsec)	Y_{SH} (arcsec)	ΔV	ΔB
1	−102.5	−71.6	0.23	0.25	23	119.8	44.7	0.62	0.63
2	−73.8	−24.5	0.25	0.35	24	119.7	−22.7	0.10	0.08
3	−59.3	89.4	0.04	0.07	25	121.8	9.4	0.43	0.39
4	−57.5	97.5	0.38	0.31	26	−87.0	−87.3	0.02	0.23
5	−55.3	86.6	0.35	0.34	27	−65.9	71.1	0.11	0.29
6	−68.5	−119.2	0.05	0.02	28	−42.9	−84.3	0.48	0.40
7	−50.6	65.9	0.09	0.07	29	−31.4	−75.4	0.17	0.70
8	−50.2	−56.1	0.75	0.67	30	−20.2	−60.0	0.12	0.13
9	−33.5	−62.1	0.34	0.44	31	34.0	−92.7	0.93	1.24
10	−16.3	63.5	0.76	0.51	32	59.7	−106.7	0.54	0.58
11	−14.0	−118.2	0.16	0.19	33	89.8	49.8	0.27	0.29
12	10.3	87.6	0.22	0.32	34	91.8	71.7	0.40	0.47
13	7.8	−61.1	0.04	0.07	35	81.8	−115.3	0.13	0.17
14	22.0	−99.2	0.29	0.28	36	94.2	71.8	0.29	0.50
15	50.7	86.9	0.05	0.04	37	84.3	−127.5	0.45	0.35
16	60.1	67.1	0.19	0.18	38	88.4	−15.7	0.05	0.10
17	51.5	−116.6	0.44	0.37	39	131.6	−48.4	0.00	0.00
18	65.9	13.0	0.08	0.13	40	136.1	−34.5	0.01	0.02
19	74.6	42.2	0.05	0.03	41	144.1	−82.0	0.01	0.02
20	84.7	−86.4	0.04	0.03	42	152.9	−6.6	0.03	0.00
21	98.1	10.5	0.14	0.12	43	193.7	−113.0	0.00	0.02
22	103.5	48.3	0.35	0.57					

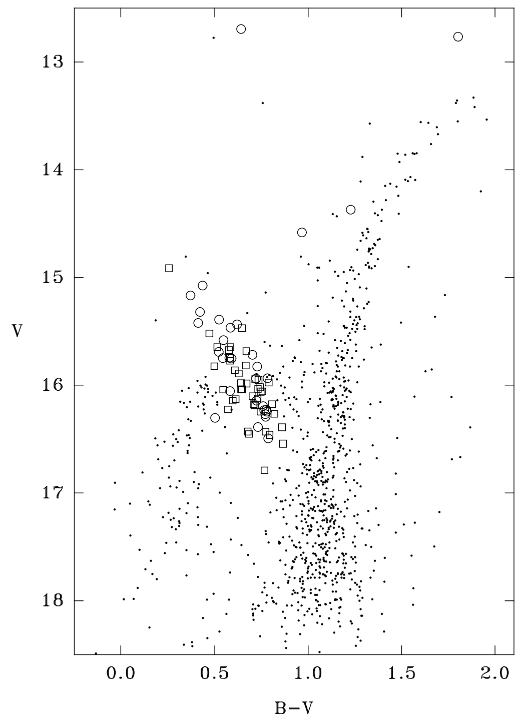

Figure 1. The color - magnitude diagram for the globular cluster NGC 6266 corrected for different reddening, the known RR Lyrae stars are denoted by circles, suspected variables are marked by squares

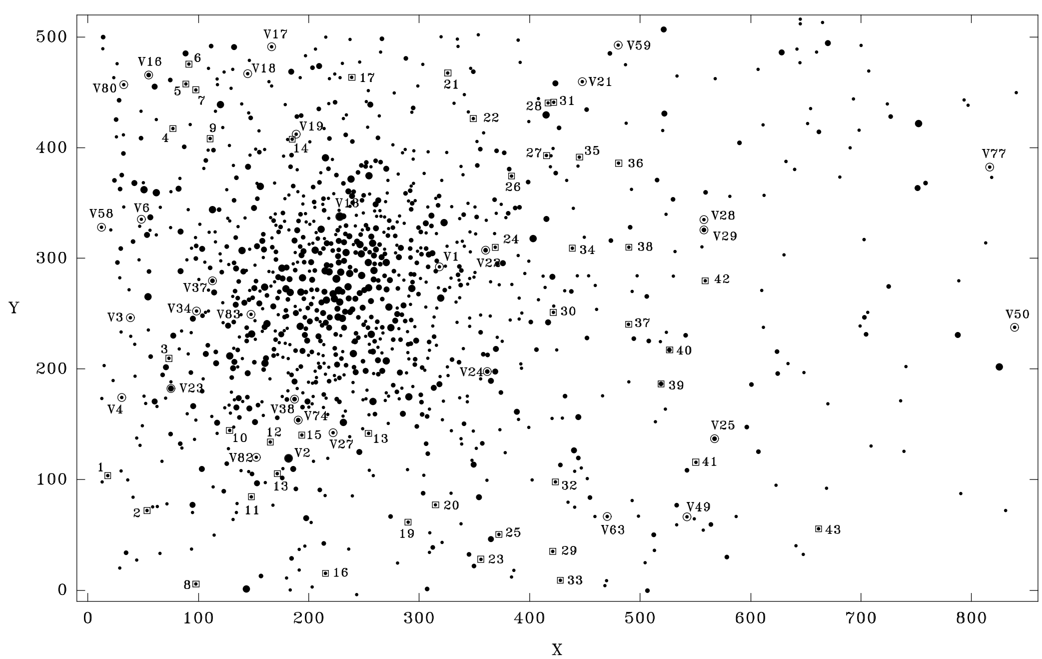

Figure 2. Finding chart for NGC 6266. The known RR Lyrae stars are denoted by circles and by their number from the catalog of SH, suspected variables are marked by squares

This study is based on CCD observations (Brocato et al., 1996). We used the same method of search for RR Lyrae variables as Kadla et al., 1996). In the investigation area ($3'.81 \times 6'.30$) there are 31 known variables. The identification of V1 and V13 was made using coordinates of SH catalog only. They were not marked on Plate 3 of Van Agt and Oosterhoff (1959) since the stars are situated in the crowded central part of the cluster. Variables V2, V23 and V37 are brighter than the other variables. In order to eliminate errors due to crowding of the central part of the cluster, we have not considered the region of the cluster center ($r < 2'$).

The differential reddening across the cluster field (Van Agt and Oosterhoff, 1959) causes an additional difficulty for the investigation of this cluster.

The colour–magnitude diagram after correction for differential reddening is shown in Figure 1. Apart from 31 known variables, there are 43 stars in the instability strip. All data for suspected variable stars are given in Table 1. The coordinates of stars in arcseconds in the system of SH's catalog and the maxima of magnitude variations ΔB and ΔV, during our observations are listed in columns 2-5 of Table 1. In Figure 1 and in the finding chart (Figure 2) the known and suspected variables are marked by circles and squares correspondingly.

Because of its position in Figure 1 we suppose that V13 is a red giant. The stars V2, V23 and V37 seem to be field variables.

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NEW VARIABLE STARS IN THE NORTHERN MILKY WAY

The following is an evaluation of a $20° \times 15°$ area centered at $22^{h}42^{m}$, $+60°$ (1950) in my series of Milky Way fields. Four fields have been previously described (Dahlmark 1982, 1986, 1993, 1996).

Nineteen plate pairs (Kodak 103aD + GG11 and 103aO) were exposed between 1967 and 1982, and forty-four were exposed on Kodak TechPan 4415 + GG495 filter in the years 1985 to 1996. Ten plate pairs were examined using a blink comparator as well as four stereo comparators in the method described by Dahlmark (1982, 1993). Magnitudes for the comparison stars were taken from the Guide Star Catalogue (GSC).

In this field 60 variables were found, of which 57 appear to be new. Table 1 shows positions and identifications. The coordinates were extracted from either the GSC (source code G), the U.S. Naval Observatory A1.0 catalogue (code A), or using the Goddard SkyView facility (code S, Scollick 1997). The lightcurves are based on 64 magnitude estimates for each star. From them the magnitude range, colour-index, provisional variability type, epoch of maximum, and period have been determined. These are collected in Table 2. An asterisk next to the star name indicates a note at the bottom of the table.

The finding charts are based on 200/210/300mm Schmidt camera photographs taken when the variable stars were at maximum light.

Table 1. Positions and identifications, LD 221–280

Name	RA (2000)	Dec	s	GSC	IRAS	Remarks
LD 221	21 13 49.9	+61 51 23	A	4248-0077	21126+6138	
LD 222	21 19 27.2	+61 26 13	A		21182+6113	
LD 223	21 24 11.8	+59 27 49	A			
LD 224	21 25 02.0	+61 59 36	A	4252-0770	21237+6146	
LD 225	21 27 27.3	+62 53 24	A		21262+6240	
LD 226	21 33 08.2	+61 46 29	A	4249-0543	21318+6133	
LD 227	21 34 31.9	+58 51 03	A			StRS 407
LD 228	21 35 55.0	+54 49 09	A			
LD 229	21 36 50.8	+54 40 58	A		21352+5427	
LD 230	21 40 06.2	+59 35 43	A		21386+5922	
LD 231	21 44 03.8	+66 39 12	A		21429+6625	
LD 232	21 48 25.2	+58 00 53	A		21468+5747	
LD 233	21 48 17.9	+62 38 07	A		21469+6224	
LD 234	21 50 59.2	+59 27 39	A		21494+5913	
LD 235	21 52 19.4	+62 48 40	A		21509+6234	
LD 236	21 53 43.3	+52 21 26	A		21519+5207	
LD 237	21 54 44.1	+63 56 22	A			
LD 238	21 55 15.4	+63 43 33	G	4266-3002	21538+6329	
LD 239	21 55 29.1	+63 56 24	A	4270-0646	21540+6341	see note
LD 240	21 57 26.1	+64 12 49	A		21560+6358	
LD 241	21 57 47.4	+64 35 26	A			
LD 242	21 58 08.6	+66 00 03	A			

Table 1. Positions and identifications, LD 221–280 (cont'd.)

Name	RA (2000)	Dec	s	GSC	IRAS	Remarks
LD 243	21 58 25.6	+63 43 28	A	4266-2925	21570+6329	
LD 244	22 01 10.5	+66 10 30	G	4275-2480		
LD 242	21 58 08.6	+66 00 03	A			
LD 243	21 58 25.6	+63 43 28	A	4266-2925	21570+6329	
LD 244	22 01 10.5	+66 10 30	G	4275-2480		
LD 245	22 01 36.7	+62 59 27	A		22001+6244	
LD 246	22 02 40.4	+61 37 30	G	4263-0653		
LD 247	22 03 21.3	+62 18 29	A		22018+6203	CGCS 5565
LD 248	22 04 21.7	+64 10 44	S		22029+6356	
LD 249	22 04 30.0	+62 04 48	A	4267-0544	22029+6150	CGCS 5569
LD 250	22 06 33.8	+64 39 59	A		22051+6425	
LD 251	22 06 59.8	+65 28 10	A	4271-0380	22056+6513	
LD 252	22 08 33.6	+63 34 54	A	4267-2710		
LD 253	22 11 00.2	+59 38 43	A	3981-0582	22093+5923	
LD 254	22 11 37.4	+60 05 32	A		22099+5950	
LD 255	22 14 26.1	+60 04 31	S		22127+5949	CGCS 5613
LD 256	22 15 39.4	+66 17 53	A			
LD 257	22 20 14.5	+60 46 14	A			
LD 258	22 22 30.0	+64 09 26	A		22208+6354	
LD 259	22 23 06.5	+56 42 50	A		22212+5627	CGCS 5644
LD 260	22 23 40.5	+58 44 56	A			24P 116
LD 261	22 26 40.3	+58 31 35	A	3995-0119	22248+5816	
LD 262	22 32 14.9	+55 10 52	A		22302+5455	
LD 263	22 35 42.0	+64 39 57	A		22339+6424	
LD 264	22 37 36.0	+61 16 09	A		22357+6100	
LD 265	22 42 54.6	+65 58 53	A		22411+6543	
LD 266	22 47 46.2	+55 18 13	A		22457+5502	GY Lac
LD 267	22 50 54.0	+62 04 43	A		22489+6148	
LD 268	22 51 32.9	+58 25 57	A		22495+5810	
LD 269	23 15 26.1	+57 27 05	A		23132+5710	
LD 270	23 18 10.6	+65 52 44	A		23160+6536	
LD 271	23 18 36.0	+64 08 52	A		23164+6352	
LD 272	23 20 00.9	+65 32 08	A		23178+6515	
LD 273	23 23 01.9	+56 15 25	S		23207+5558	
LD 274	23 25 31.3	+55 22 07	G	4003-1940	23232+5505	
LD 275	23 26 27.2	+53 53 07	A		23241+5336	see note
LD 276	23 29 25.1	+64 59 40	A		23271+6443	CGCS 5885
LD 277	23 37 39.7	+58 50 47	S		23352+5834	see note
LD 278	23 46 10.0	+58 40 17	A		23437+5823	
LD 279	23 49 13.4	+54 54 04	A		23467+5437	
LD 280	23 52 09.1	+66 34 50	A		23496+6618	see note

Notes to Table 1:

LD 239 CGCS 5508, also Cl* Berkeley 93 SSWZ 154 from Saurer *et al.* (1994); from plates on five nights and CCD frames on two nights, they find: $14.6 < V < 15.4$, B–V = 3.8.

LD 275 V354 Cas: GCVS4 position error; ID verified on MVS no. 281.

LD 277 spectral type M5/7 (Dolidze 1975).

LD 280 IRC +70202 = TASV J2352+665 (Collins 1996).

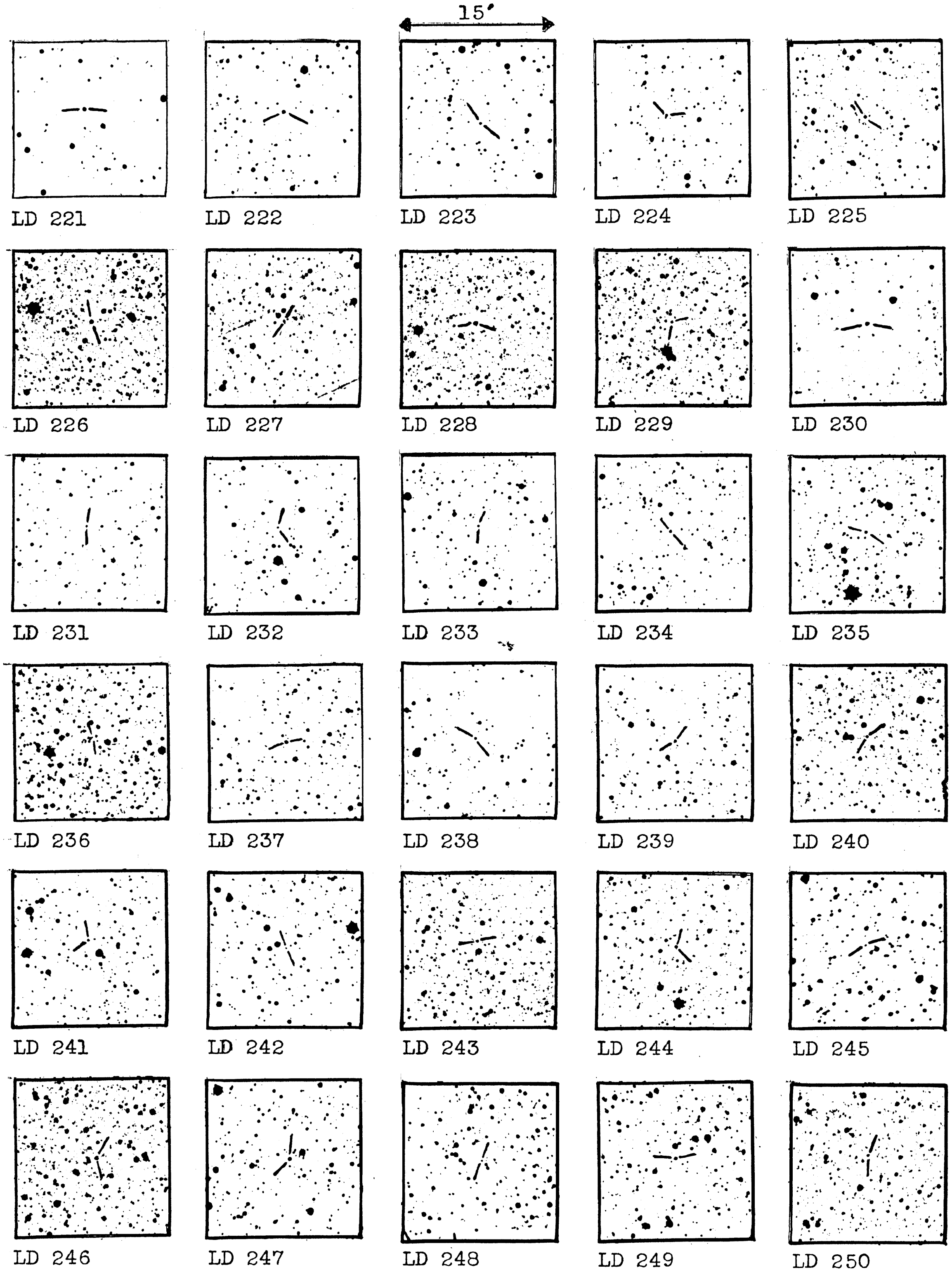
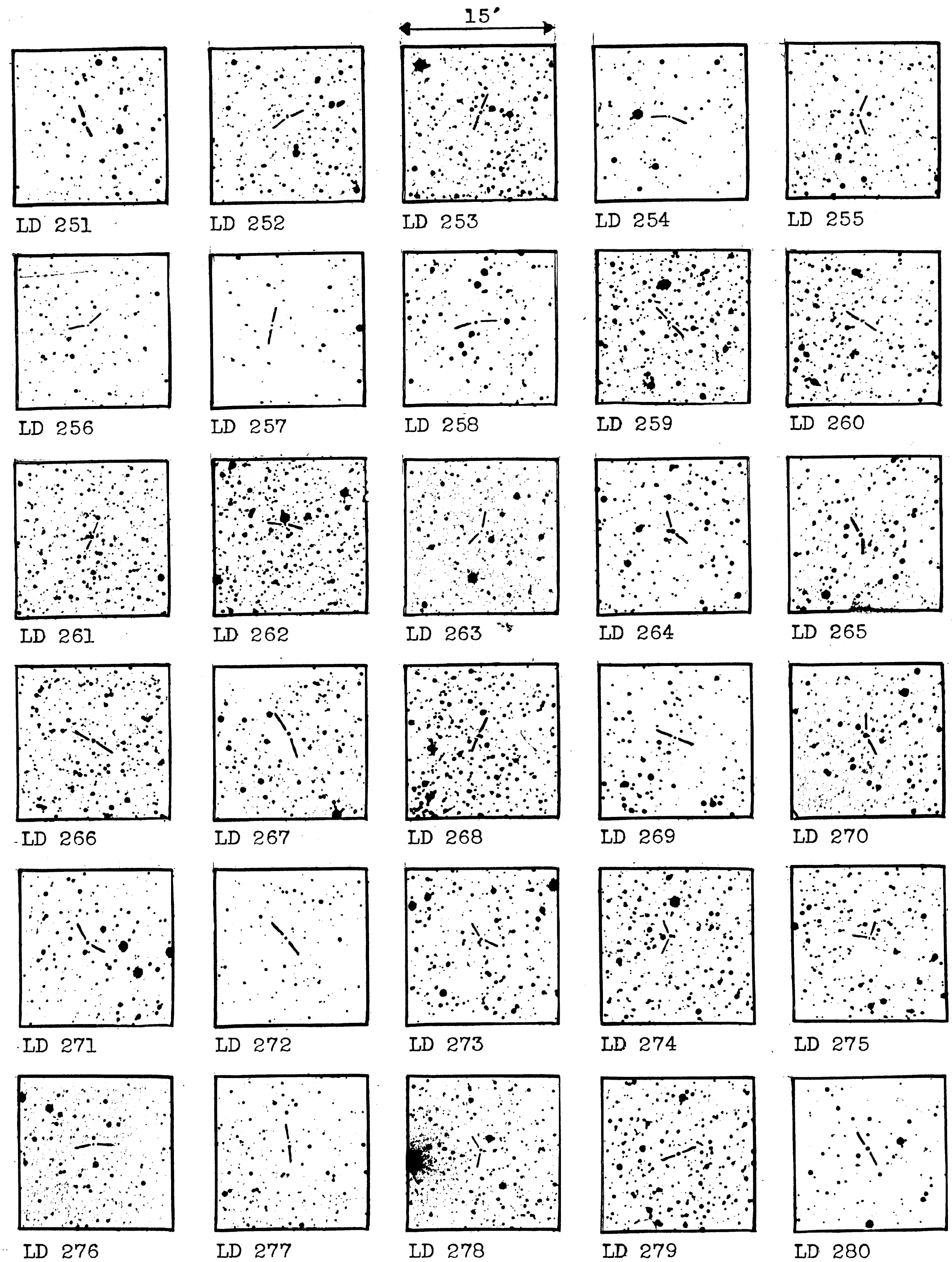

15'
LD 221
LD 222
LD 223
LD 224
LD 225
LD 226
LD 227
LD 228
LD 229
LD 230
LD 231
LD 232
LD 233
LD 234
LD 235
LD 236
LD 237
LD 238
LD 239
LD 240
LD 241
LD 242
LD 243
LD 244
LD 245
LD 246
LD 247
LD 248
LD 249
LD 250

Figure 1


15′
LD 251
LD 252
LD 253
LD 254
LD 255
LD 256
LD 257
LD 258
LD 259
LD 260
LD 261
LD 262
LD 263
LD 264
LD 265
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LD 267
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LD 269
LD 270
LD 271
LD 272
LD 273
LD 274
LD 275
LD 276
LD 277
LD 278
LD 279
LD 280

Figure 2

Table 2. Elements of variation, LD 221–280

Name	max min (mv)	mb–mv	type	epoch JD 2400000+	period (days)
LD 221	11.8 – 13.7	2.1	SRa	50273	254
LD 222	12.1 – 16.0	1.4	M	49681	353
LD 223	13.5 – 15.5	>2	SRa	47862	315
LD 224	13.4 – 15.3	0.8	SRa	49541	265
LD 225	13.2 – 15.0	1.0	SRa	50273	246
LD 226	11.8 – 14.3	2	SRa	50200	248
LD 227	13.5 – 15.6	1.2	SRa	49954	331
LD 228	11.7 – 13.6	>2	Lb		
LD 229	13.3 – >16.2		L		
LD 230	12.3 – 14.7	>2.5	SRa	49954	404
LD 231	14.3 – 15.3	1	Lb		
LD 232*	13.7 – 15.1	>1.5	SRb	49681	390
LD 233	12.6 – 14.5	1.1	SRb	49870	120
LD 234	12.8 – 14.8	1.2	Lb		
LD 235	12.9 – >16.0		M	49920	495
LD 236	12.4 – >16.0	>1.6	M	49809	611
LD 237	11.5 – >16.0	2	M	50360	380
LD 238	12.0 – 14.7	2.5	M	49809	212
LD 239	13.5 – 14.8	>2	Lb		
LD 240	12.2 – 15.5	2.3	M	50305	310
LD 241	14.1 – 15.3	0.7	SRa	50337	146
LD 242	11.8 – 16.0	1.3	M	49809	155
LD 243*	11.4 – 15.2	2.1	M	50250	453
LD 244	12.0 – 14.5	>2	SRb		392?
LD 245	12.4 – 15.3	>2.2	M	50188	350
LD 246*	12.4 – 14.7	1.8	SRa		350
LD 247	11.8 – 14.1	3.5	Lb		
LD 248	14.1 – >16.0		Lb		
LD 249	12.0 – 14.3	>3	Lb		
LD 250*	13.0 – 14.9	2.2	SRb	50188	224
LD 251	11.8 – 14.6	2.0	M	49681	381
LD 252	12.5 – >16.0		M	49895	283
LD 253	12.5 – 16.0	>2	M	50305	266
LD 254	13.2 – >16.0	2.6	M	50337	231
LD 255	12.7 – 14.4	>3	SRa	50305	398
LD 256	13.8 – 15.0	>1.5	Lb		
LD 257	13.2 – 14.0	1	L		
LD 258	13.6 – >16.0	>2	M	50360	335
LD 259	12.2 – 14.6	>1	M	50000	370
LD 260	14.0 – 15.2		L		
LD 261	11.0 – 13.3	2	Lb		
LD 262	13.8 – 15.5		SRb	49360	339
LD 263	13.0 – 15.8	>1.3	M	49987	318
LD 264	11.8 – >14.5	2.0	M	50350	227
LD 265	10.9 – 16.0	>1.6	M	49809	341
LD 266*	11.6 – 15.2	1.6	M	49650	380

Table 2. Elements of variation, LD 221–280 (cont'd.)

Name	max – min (mv)	mb–mv	type	epoch JD 2400000+	period (days)
LD 267*	12.8 – 16.0		M	50337	265
LD 268	12.6 – >16.0	>1.5	M	50188	162
LD 269	12.5 – >16.2		L		
LD 270	11.9 – 16.1	1.1	M	50360	366
LD 271	13.0 – 15.0	>1	SR	50360	232
LD 272	12.7 – 16.0	>1.8	M	49919	151
LD 273	12.6 – >15.0	>1.2	SR		265?
LD 274	12.5 – >15.0		M	50360	273
LD 275	11.0 – 15.2	>2	M	49843	369
LD 276	12.6 – 15.3	>1	L		
LD 277	12.9 – 15.2		SR	49809	365
LD 278	13.1 – 15.1	>1	SR	49954	255
LD 279	12.5 – 15.5		M	49542	400
LD 280*	11.3 – 14.6	2.1	M	50360	332

Notes to Table 2:

LD 232 period variable: 380–400^{d}?

LD 243 period decreasing: 1968-77 = 469^{d}, 1977-87 = 462^{d}, 1992-96 = 453^{d}.

LD 246 period unstable: 330-370^{d}.

LD 250 period variable: 1975 = 202^{d}.

LD 266 period decreasing: 1975 = 408^{d}, 1985 = 391^{d}, 1995 = 380^{d}.

LD 267 period decreasing: 1967-70 = 288^{d}, 1987 = 276^{d}, 1994 = 273^{d}, 1995 = 267^{d}, 1996 = 264^{d}.

LD 280 period increasing: 1970-79 = 328^{d}, 1979-88 = 330^{d}, 1988-1996 = 332^{d}.

I would like to thank Brian Skiff (Lowell Observatory) for helping me find accurate positions and the identifications of my stars from various catalogues.

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COMMISSIONS 27 AND 42 OF THE IAU
INFORMATION BULLETIN ON VARIABLE STARS

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IDENTIFICATIONS FOR BAADE'S VARIABLES IN SAGITTA AND CYGNUS

The tables below show identifications and precise positions for a group of variables found by Walter Baade (1928) during his Bergedorfer days. The stars reported in this survey are of some historical interest because it was as a result of this work that Baade conceived ideas that led to his later recognition of the two stellar populations among Galactic stars (*cf.* Osterbrock 1995).

The paper is one of the few variable-star surveys where precise positions are supplied (for equinox 1925), so checks and identifications were easy to make in modern catalogues. I examined each star on the digitized sky survey using the Goddard SkyView facility (Scollick 1997). Baade's original positions in his Table 1 are very good, all less than $2''$ from FK5-system positions, and often within $1''$. In the Cygnus field (Table 2), they are somewhat less good, but still within about $3''\!.5$. In either case, making identifications on the sky is unambiguous despite the absence of finder charts. Follow-up lightcurves and photometry of comparison stars with finding charts for several of Baade's short-period variables can be found in Henden (1996) and Schmidt & Seth (1996).

The stars are listed in the same order as in Baade's tables. The first column shows the provisional "Kiel" designation used in the *Astronomische Nachrichten* (Baade did not give all of these). Next comes the proper variable-star name, taken directly from the machine-readable version of volume 4 of the GCVS4 available from the Strasbourg CDS ftp service. N.B. the mix of O's and Q's among the names in Table 2. Since few of the stars appear in the GSC, I have by preference extracted positions from the U. S. Naval Observatory UJ1.0 star catalogue (Monet *et al.* 1996a), or the more comprehensive A1.0 catalogue (Monet *et al.* 1996b). The few remaining positions were taken directly from Baade, or estimated to $\pm 2''$ using SkyView. The source of the position is coded as follows: A = A1.0, B = Baade, S = SkyView, U = UJ1.0.

Table 1. Baade's variables in Sagitta

Provis. desig.	Name	RA (2000)	Dec	s	GSC	IRAS	n
AN 135.1905	SZ Sge	19 54 59.2	+19 20 29	U			
AN 9.1928	NSV 12613	19 57 43.6	+18 21 23	U			
AN 10.1928	NSV 12582	19 56 24.5	+19 49 39	U	1624-1733		
AN 11.1928	EI Sge	19 59 07.5	+19 27 53	U			
AN 12.1928	NSV 12554	19 54 54.1	+19 12 24	U			
AN 13.1928	NSV 12589	19 56 42.4	+19 16 51	U			
AN 14.1928	FX Sge	19 54 20.2	+18 46 39	U			
AN 156.1905	TX Sge	20 03 04.4	+19 15 58	U		20008+1907	
AN 15.1928	NSV 12654	19 59 16.3	+18 44 47	U			
AN 138.1905	TU Sge	19 55 21.8	+19 16 46	U	1624-2400		
AN 16.1928	NSV 12570	19 55 41.4	+18 47 01	U			
AN 129.1905	Y Sge	19 53 30.9	+18 14 29	U		19512+1806	
AN 17.1928	NSV 12732	20 02 48.6	+18 28 14	U	1621-1800		
AN 18.1928	NSV 12571	19 55 41.7	+19 38 39	U			
AN 19.1928	NSV 12546	19 54 34.8	+18 51 54	U			
AN 20.1928	NSV 12639	19 58 48.3	+18 58 50	U			

Table 1. Baade's variables in Sagitta (cont'd.)

Provis. desig.	Name	RA (2000)	Dec	s	GSC	IRAS	n
AN 21.1928	NSV 12640	19 58 47.9	+19 57 05	U			
AN 22.1928	NSV 12699	20 01 29.2	+18 37 56	U	1621-0052		
AN 23.1928	NSV 12631	19 58 31.9	+19 29 01	U			
AN 143.1905	RR Sge	19 56 53.3	+19 37 02	U		19546+1928	
AN 24.1928	NSV 12677	20 00 24.2	+19 02 10	U			
AN 25.1928	DO Vul	19 52 10.6	+19 34 44	B			*
AN 33.1926	SY Sge	19 54 53.5	+18 14 02	U	1620-0472		*
AN 144.1905	RX Sge	19 56 56.2	+18 56 06	U	1624-1910	19547+1848	
AN 26.1928	DW Sge	19 55 54.3	+19 32 36	U			
AN 145.1905	RS Sge	19 57 06.4	+19 59 44	U	1624-2141	19548+1951	
AN 27.1928	NSV 12567	19 55 26.0	+19 01 02	A			
AN 28.1928	NSV 12648	19 59 07.8	+18 07 26	U	1620-2194	19568+1759	
AN 29.1912	Z Sge	19 53 56.1	+18 47 17	U	1624-2120	19516+1839	
AN 29.1928	NSV 12628	19 58 17.1	+18 33 38	U	1620-0828	19560+1825	
AN 30.1928	NSV 12545	19 54 31.4	+19 21 24	U			
AN 31.1928	NSV 12544	19 54 28.1	+18 19 49	U	1620-2328		
AN 32.1928	NSV 12480	19 51 34.1	+20 02 16	U			
AN 33.1928	NSV 12504	19 52 29.4	+19 06 38	U			
AN 34.1928	NSV 12528	19 53 49.0	+18 53 06	U	1624-2957		*
AN 35.1928	NSV 12713	20 01 52.1	+19 25 51	U	1625-2044		
AN 36.1928	NSV 12517	19 53 08.7	+18 08 17	U	1620-2016		
AN 37.1928	NSV 12641	19 58 56.8	+18 06 16	U			
AN 38.1928	NSV 12491	19 51 57.8	+19 20 34	U		19497+1912	
AN 39.1928	NSV 12478	19 51 24.3	+18 41 10	U	1619-0843		
AN 40.1928	NSV 12622	19 57 55.1	+18 54 51	U			
AN 152.1905	TW Sge	19 58 55.6	+18 13 03	A			
AN 41.1928	NSV 12610	19 57 38.5	+18 28 58	U			
AN 42.1928	AP Sge	19 54 20.8	+19 21 57	U	1624-1184		
AN 43.1928	DP Vul	19 52 18.1	+19 39 27	U			
AN 44.1928	NSV 12578	19 56 05.4	+19 20 31	A			
AN 45.1928	NSV 12602	19 57 13.4	+18 20 06	U			
AN 46.1928	NSV 12645	19 58 59.7	+17 58 33	U			
AN 47.1928	NSV 12715	20 01 52.7	+20 03 53	U			
AN 48.1928		19 53 49.4	+18 44 27	U	1620-0122		*
AN 49.1928	NSV 12663	19 59 39.2	+19 29 07	A			
AN 50.1928	NSV 12675	20 00 15.3	+19 21 39	U			*
AN 51.1928	NSV 12666	20 00 06.2	+18 37 15	U			
AN 52.1928	NSV 12594	19 56 53.4	+19 40 08	U			
AN 53.1928	NSV 12561	19 55 09.3	+18 42 29	U			
AN 54.1928	NSV 12660	19 59 32.2	+19 00 30	B		19573+1852	
AN 55.1928	NSV 12590	19 56 43.9	+18 50 17	U			
AN 56.1928	VW Sge	19 57 31.4	+19 48 36	U			
AN 57.1928	NSV 12485	19 51 48.6	+19 22 52	U	1623-2167		
AN 58.1928	NSV 12543	19 54 22.0	+18 52 05	U	1624-0924		
AN 59.1928	NSV 12597	19 57 01.2	+20 05 43	B			*
AN 60.1928	NSV 12633	19 58 35.5	+19 10 06	U			
AN 127.1905	RW Sge	19 52 33.2	+19 06 23	U	1624-3188	19503+1858	
AN 61.1928	VV Sge	19 55 34.4	+19 21 13	U		19533+1913	
AN 137.1905	TT Sge	19 55 13.6	+19 07 04	U			
AN 62.1928	NSV 12606	19 57 29.2	+19 17 29	U	1624-1258	19552+1909	*
AN 63.1928	NSV 12599	19 57 04.1	+19 32 19	U			
AN 64.1928	NSV 12649	19 59 07.0	+18 44 18	U			
AN 65.1928	NSV 12514	19 53 02.2	+18 25 35	U			
AN 66.1928	NSV 12625	19 58 05.2	+19 14 09	U			
AN 131.1905	SX Sge	19 53 49.1	+18 22 03	A		19515+1814	

Notes to Table 1:

SY Sge HD 350944 = LS II +18°17.

DO Vul no star on DSS precisely at Baade's position. The Downes & Shara (1993) dwarf-nova atlas identifies this as the northwestern star of a faint pair at position end-figures $10^{s}.9/43''$. The identification is uncertain, however, since there have been no outbursts reported in the modern literature.

NSV 12528 BSNS 32.

AN 48.1928 NGC 6838 V2 = Cl* NGC 6838 ZDA 16.

NSV 12675 equal $\sim 4''$ pair on DSS, resolved in UJ1.0. Baade's position is close to the mean of the two, which was adopted.

NSV 12597 evidently the southwestern star of a merged pair on DSS. The position (from Baade) given by Richter & Greiner (1996) is in error by $+10''$; they identify the northeastern star of the pair as the variable.

NSV 12606 excellent IRAS position match, but the [12–25] color is relatively blue.

Table 2. Baade's variables in Cygnus

Provis. desig.	Name	RA (2000)	Dec	s	GSC	IRAS	n
AN 67.1928	PU Cyg	19 56 15.8	+37 52 06	U	3137-0124	19544+3743	
AN 68.1928	QZ Cyg	19 59 04.1	+38 15 44	U	3137-2987	19572+3807	*
AN 69.1928	QX Cyg	19 58 34.7	+38 14 35	U	3137-2869		
AN 70.1928	PR Cyg	19 55 41.1	+38 16 04	U	3137-1721	19538+3807	
AN 71.1928	OV Cyg	19 54 14.3	+38 25 27	U			
AN 72.1928	OP Cyg	19 52 48.4	+38 13 17	U			
AN 73.1928	PT Cyg	19 56 07.3	+38 44 40	A			
AN 74.1928	V341 Cyg	20 00 57.8	+38 54 45	U	3150-1417	19591+3846	
AN 75.1928	V342 Cyg	20 03 47.8	+38 57 51	A		20020+3849	
AN 76.1928	OY Cyg	19 54 43.9	+39 17 58	U	3137-1152	19529+3910	
AN 77.1928	FZ Cyg	19 51 13.0	+39 04 46	U		19494+3857	
AN 78.1928	V339 Cyg	20 00 28.9	+38 44 08	A		19586+3835	
AN 79.1928	GK Cyg	20 00 34.5	+39 36 36	U	3154-1020	19587+3928	
AN 80.1928	NQ Cyg	19 49 54.6	+38 08 24	A			
AN 81.1928	QQ Cyg	19 57 32.9	+38 05 30	U			
AN 82.1928	V336 Cyg	19 59 54.4	+38 46 42	U			
AN 83.1928	GM Cyg	20 04 15.9	+38 07 43	U	3150-2692		
AN 84.1928	V344 Cyg	20 04 15.0	+38 57 27	U			
AN 85.1928	GL Cyg	20 03 34.7	+39 09 35	U	3150-0577		
AN 86.1928	QW Cyg	19 58 30.5	+37 29 14	U			
AN 87.1928	OZ Cyg	19 55 15.7	+38 15 34	A			
AN 88.1928	NV Cyg	19 51 54.2	+38 46 04	U			
AN 89.1928	NS Cyg	19 50 42.1	+39 28 47	U	3141-1041		
AN 90.1928	NSV 12556	19 54 35.2	+39 03 49	U			
AN 91.1928	NW Cyg	19 51 58.8	+38 54 10	B		19502+3846	
AN 92.1928	NY Cyg	19 52 34.6	+37 55 44	U			
AN 93.1928	PV Cyg	19 56 29.2	+37 43 08	U	3137-3117		
AN 94.1928	OT Cyg	19 54 07.4	+38 18 39	U			
AN 95.1928	OW Cyg	19 54 30.3	+37 30 21	U			
AN 96.1928	NSV 12601	19 56 45.6	+37 42 01	U			
AN 97.1928	QU Cyg	19 58 27.9	+38 13 27	A			
AN 98.1928	V338 Cyg	20 00 03.0	+38 58 28	A		19582+3850	
AN 99.1928	OQ Cyg	19 53 32.8	+37 51 47	U	3137-1524	19517+3743	
AN 100.1928	QT Cyg	19 58 07.4	+38 49 28	U			
AN 101.1928	V337 Cyg	19 59 53.6	+39 13 55	U			
AN 102.1928	NSV 12678	20 00 00.5	+38 35 50	U	3150-2033	19582+3827	
AN 103.1928	PZ Cyg	19 57 27.6	+39 14 12	U			
AN 104.1928	PY Cyg	19 56 57.2	+38 55 05	U			
AN 105.1928	QR Cyg	19 57 31.0	+38 27 46	U	3137-2489		
AN 8.1926	CV Cyg	19 54 20.9	+38 02 50	U	3137-0824		
AN 106.1928	QS Cyg	19 57 39.5	+38 48 20	U			
AN 107.1928	OU Cyg	19 54 10.2	+38 41 34	U			

Table 2. Baade's variables in Cygnus (cont'd.)

Provis. desig.	Name	RA (2000)	Dec	s	GSC	IRAS	n
AN 108.1928	OX Cyg	19 54 39.4	+39 15 00	U			
AN 109.1928	QY Cyg	19 58 51.6	+37 38 50	U	3137-3257		
AN 110.1928	NX Cyg	19 52 04.1	+37 52 41	U			
AN 111.1928	PS Cyg	19 56 06.2	+38 00 08	U			
AN 112.1928	OS Cyg	19 53 58.3	+39 12 08	U			
AN 113.1928	V340 Cyg	20 00 54.4	+39 01 44	U			
AN 114.1928	NSV 12576	19 55 30.4	+37 35 52	U	3137-3464		
AN 115.1928	PW Cyg	19 56 31.0	+39 30 32	U	3141-3532		
AN 116.1928	NT Cyg	19 51 06.4	+39 00 43	B		19493+3852	
AN 117.1928	PP Cyg	19 55 16.4	+39 27 08	A		19535+3919	
AN 118.1928	NN Cyg	19 49 27.3	+38 44 47	U			
AN 119.1928	OO Cyg	19 52 44.9	+37 58 48	U			
AN 120.1928	PQ Cyg	19 55 36.3	+37 51 20	U			
AN 121.1928	V343 Cyg	20 04 04.5	+39 06 15	U			
AN 122.1928	NSV 12420	19 47 43.3	+37 56 00	U			
AN 123.1928	NR Cyg	19 50 41.5	+37 46 33	U	3137-0303		
AN 124.1928	V1252 Cyg	19 51 48.9	+39 00 37	U		19500+3852	
AN 125.1928	V335 Cyg	19 59 54.4	+38 06 39	U	3137-2863		
AN 126.1928	NO Cyg	19 49 41.1	+38 11 38	U	3136-0455		
AN 127.1928	NP Cyg	19 49 51.4	+37 46 28	U			
AN 128.1928	QV Cyg	19 58 25.9	+38 46 42	U	3137-3036		
AN 129.1928	NZ Cyg	19 52 37.5	+38 42 58	U			
AN 130.1928	NU Cyg	19 51 37.7	+39 07 21	U			
AN 131.1928	OR Cyg	19 53 35.9	+37 58 59	U			
AN 132.1928	PX Cyg	19 56 44.1	+37 37 39	U	3137-3651		

Note to Table 2:
QZ Cyg BD+37°3710.

I used SIMBAD to look for the GSC and IRAS identifications. Additional remarks are indicated by an asterisk and given following the tables.

I am grateful to Gérard Jasniewicz (Université de Montpellier), who pointed out several typos in an early version of this list. Taichi Kato (Kyoto University) provided comments on DO Vul.

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COMMISSIONS 27 AND 42 OF THE IAU
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ON THE NAME "OVER-CONTACT BINARY SYSTEMS"

During the recent years, a new name of a group of binary stars seems to have appeared. These are "over-contact binaries". The name is clear and persuasive in its content: Since contact binary stars exists, the new name implies existence of binary stars that are in better or "more" contact than ordinary contact systems. In this note I would like to express the opinion that the name is currently being used incorrectly and that it should be reserved for possible cases of genuine overflow of the outer critical equipotential surface.

The name in question has been surfacing from time to time in the literature, but has been particularly frequently used recently in the IBVS. A brief look at the titles starting with the issue number 4301 and continued to the most recent available number 4433 shows that it has been used in five instances (issues numbers 4324, 4364, 4365, 4424, 4427). In all these cases normal contact binaries of the W UMa-type are described. Not a single case indicated overflow through the external Lagrangian point L_2, arguably a reason to call a system an "over-contact" one.

The basic groups of close binary stars have been discussed and defined by Kopal (1959) in his monumental book. They have been divided into detached, semi-detached and contact systems according to the relation to the critical equipotentials passing through the inner critical point L_1. These potentials, known also as "Roche lobes", although invisible and not material, act as lips dividing the connected vessels (cf. Pringle 1985, Fig. 1.4). The group of contact binaries was defined clearly by Kopal (1959, Sec. VII.6) as systems filling the common envelope encompassing both stars. The observationally-defined group of W UMa-type eclipsing binaries was equated there with the theoretical concept of contact binaries, i.e. binaries whose surfaces are described by potentials intermediate between those that pass through the critical Lagrangian points L_1 and L_2.

The meaning of the contact systems has gained a real solid basis after the two seminal papers by Lucy (1968a, 1968b) who showed that single structures with two mass centres can exist and can produce light curves exactly as those of the W UMa-type. Since then a large body of literature on contact binary stars has appeared. The name of W UMa-type systems has attained the status of an operational definition of contact binaries with orbital periods shorter than one day which consist mostly of solar-type stars, whereas the name of "early-type contact binaries" is used for rare systems with orbital periods longer than one day.

Apparently, the new name originated through the incorrect application of the name "contact" to describe the relation of a star to its equipotential surface. Thus, the phrase "to be in contact" has been sometimes used to describe that the surface of a star is *in contact with the particular (critical) equipotential*; correspondingly, the component filling its Roche lobe would be then called a "contact component". This usage is illustrative, but carries a danger that it may lead to misunderstanding: the equipotential is not a solid surface in space and there is nothing to be in contact with. Whereas stars in a binary system can be in contact, a single star cannot really be in contact with a non-material surface.

The new name of "over-contact" seems to have originated through a logical step further, to describe the cases when the stellar surfaces are located outside the inner critical (or Roche lobe) surfaces. Here, I would like to argue, that – in such situations – the star either (slightly) over-fills its critical equipotential (and then is part of a semi-detached system) or forms a structure described by a common equipotential, effectively making it to be *in contact* with the other component.

I propose that the name contact binary be used to describe systems which fill the common equipotentials and form single bodies with two mass centres, and that the name over-contact be reserved for, so far undetected, cases of genuine overflow of the contact configurations. Such may exist, probably briefly, but their discovery would be of immense importance for our understanding of the the angular momentum loss evolution, which for many close binaries carries them through the successive stages of detached, semi-detached, contact binary systems and then – at the end, through a brief stage of over-contact – to single stars. In light of this more rigorous definition, a claim that we know over-contact systems is certainly an over-statement.

I would like to thank Hilmar Duerbeck and Carla Maceroni for supporting me with the idea of publishing this note.

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UBV OBSERVATIONS OF T CrB

T Coronae Borealis is a spectroscopic binary, with a period of 227.5 days, containing an M3 giant and a hotter companion. The star has experienced two outbursts with an amplitude of about 8 mag in 1866 and 1946, and is classified as a recurrent nova as well as a symbiotic star. The ultraviolet observations and the behaviour of the star during the outbursts point to the hotter component is an white dwarf with a mass close to the Chandrasekhar limit (Selvelli, Cassatella and Gilmozzi, 1992), in spite of the existence of some doubts that it can be a main sequence star (e.g. Kenyon and Garcia, 1986). The M giant fills the Roche lobe and the main part of the accretion is realized through the L_1.

UBV observations of the recurrent nova T CrB were carried out with a single channel photon counting photometer, mounted at the 0.6 m telescope of the National Astronomical Observatory "Rozhen". The comparison star was HD 142929 ($V = 8\overset{m}{.}41$, $B-V = 0\overset{m}{.}51$, $U-B = 0\overset{m}{.}03$). The data was processed using the APRN software (Kirov et al., 1991). The accuracy is better than ± 0.04 mag. Our observations are summarized in Table 1.

The long term photometry in the U band is presented in Figure 1. The triangles indicate our data, the circles denote the data from Hric et al. (1991, 1993, 1994) and Skopal et al. (1992,1995), the crosses denote the data of Mikolajewski et al. (1996). From Figure 1 it is visible that since 1990 TCrB has experienced three small outbursts with an amplitude of $\sim$1 mag in the U band and peaks at JD 2448100, JD 2449100 and JD 2450200. The typical time between these mini outbursts is of about 1000 days. Since 1994 the star has shown a considerable increase in the U brightness. It is interesting to note that UV flux observations of Selvelli, Cassatella and Gilmozzi (1992) over the period 1979-90 do not show similar behaviour. They had observed only two minima in 1979 and 1989.

In the V band as well as in the IR (see Yudin and Munari, 1993 and references therein), TCrB shows a double wave light curve, as a result of the ellipsoidal shape of the M giant. In Figure 2 the V data are shown, using the ephemeris of Kenyon and Garcia (1986). The dots refer to the data obtained before 1989: Lines et al. (1988), Rajkova and Antov (1986) and Bruch (1980, 1992). The other symbols are the same as in Figure 1. A Fourier analysis of the data using a three-term truncated Fourier series yields

$$V = (10.080 \pm 0.005) + (0.018 \pm 0.007)\cos\phi + (0.162 \pm 0.007)\cos 2\phi - (0.019 \pm 0.007)\cos 4\phi \\ + (0.018 \pm 0.008)\sin\phi + (0.039 \pm 0.007)\sin 2\phi + (0.015 \pm 0.008)\sin 4\phi,$$

where ϕ is the orbital phase. This fit is also plotted in Figure 2. Although the data spread over 17 years a distinction between the observations obtained in different epochs is not visible. This points to the fact that the V light curve has not changed in its main features over the last 17 years.

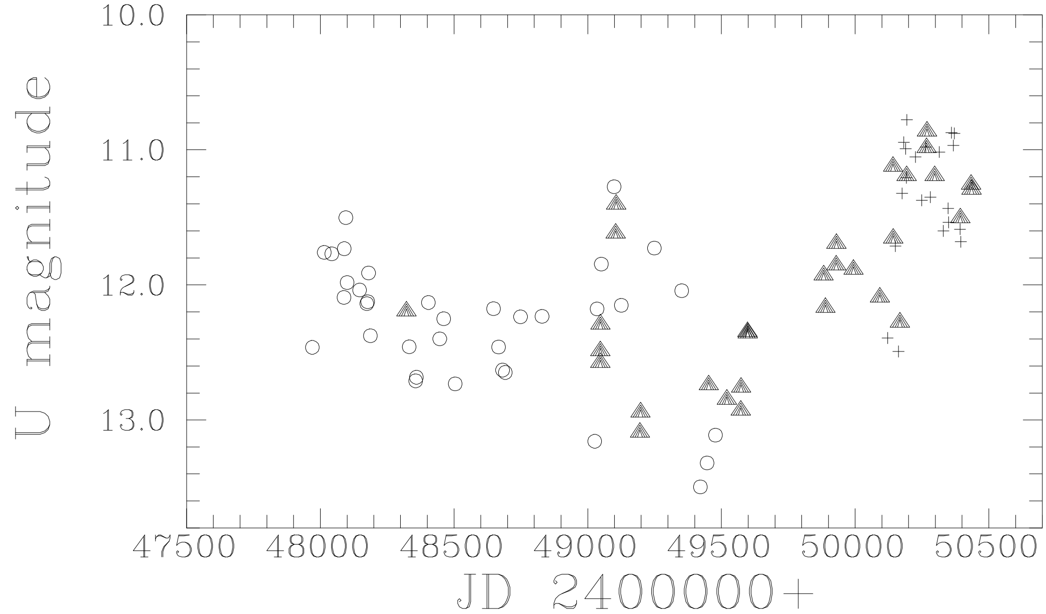

Figure 1. U band light curve of T CrB

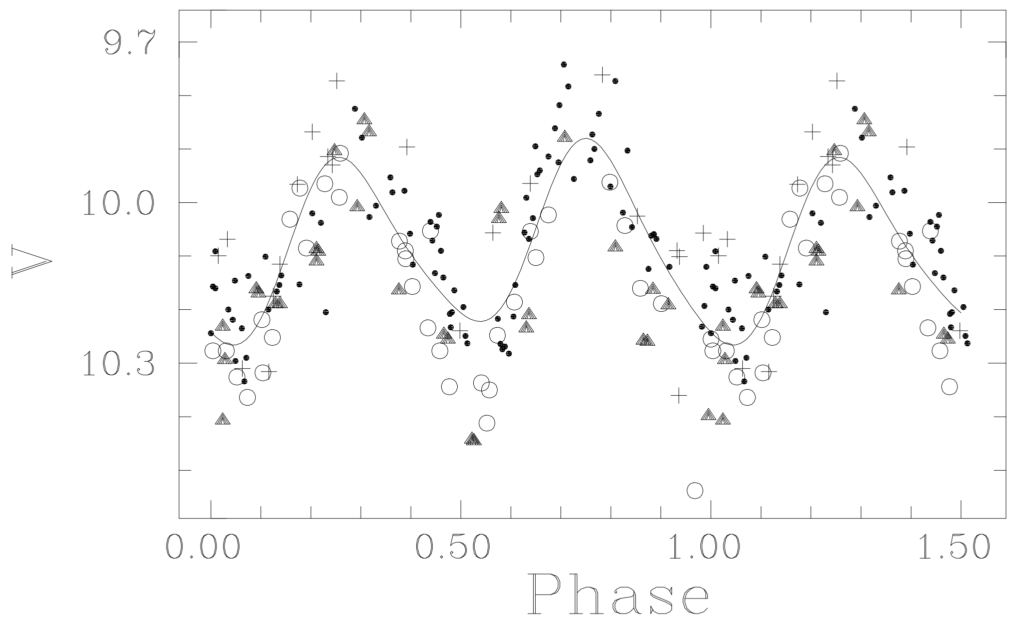

Figure 2. Phase plot of the V data according to
the orbital ephemeris of Kenyon and Garcia (1986)

Most of the radiation flux in the U is emitted from the hotter component. The ellipsoidal variations are suggestive of a large orbital inclination but an eclipse cannot be detected in the UV flux (Selvelli et al., 1992). We also fail to detect eclipse in the U band. The U magnitudes of TCrB do not show correlation with the orbital period. It is worth noting that the eccentricity of the system is practically zero (Kenyon and Garcia, 1986) so the lack of connection with the orbital period is not surprising.

We ascribe the variability in the U band to the accretion disk and/or the boundary layer between the disk and the white dwarf. In our opinion the most likely reason for the observed variability is the changes in the mass transfer rate and/or in the structure of the accretion disk.

Table 1. Photometric observations of T CrB

JD2400000+	V	$B-V$	$U-B$		JD	V	$B-V$	$U-B$
48321.44	10.40	1.40	0.37		49889.34	10.19	1.45	0.51
49046.57	10.11	1.54	0.92		49929.37	10.16	1.36	0.32
49046.60	10.08	1.54	0.84		49930.39	10.17	1.33	0.18
49047.54	10.09	1.51	0.68		49994.23	10.16	1.36	0.34
49104.53	10.24	1.24	0.12		50092.66	10.08	1.43	0.57
49106.45	10.25	1.18	-0.05		50141.64	10.23	1.08	-0.20
49195.32	10.25	1.61	1.21		50142.57	10.29	1.27	0.08
49197.32	10.26	1.56	1.11		50167.52	10.19	1.46	0.62
49452.51	10.40	1.53	0.80		50192.39	9.90	1.14	0.13
49520.40	10.01	1.53	1.30		50267.36	10.03	1.16	-0.22
49572.32	10.44	1.56	0.92		50268.36	10.01	1.14	-0.30
49573.29	10.44	1.52	0.78		50297.30	9.88	1.22	0.08
49597.27	10.23	1.49	0.61		50393.18	10.19	1.25	0.05
49598.29	10.21	1.49	0.64		50433.66	9.84	1.29	0.11
49882.33	10.16	1.37	0.38		50435.66	9.87	1.29	0.12

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Skopal, A., Hric, L., Chochol, D., et al., 1995, *Contr. Astr. Obs. Skalnaté Pleso*, **25**, 53
Yudin, B., Munari, U., 1993, *A&A*, **270**, 165

CORRIGENDA

In the No. 4428 issue of the IBVS, Figure 2 is erroneously the repetition of Figure 1. The correct version of Figure 2 is as follows:

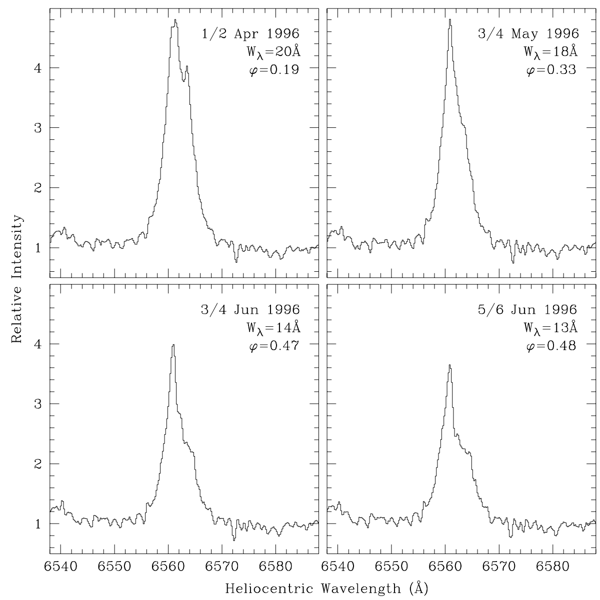

Figure 2. T CrB Hα profiles in 1996. The equivalent width and orbital phase are written in each box

⋆⋆⋆

The hardcopy of IBVS No. 4430 has been distributed in an incomplete form: the last three references (page 4) are missing. The references cut off the end of the paper are as follows:

Krisciunas, K., Crowe, R.A., Luedeke, K.D., and Roberts, M., 1995, *MNRAS*, **277**, 1404
Krisciunas, K., and Handler, G., 1995, *IBVS*, No. 4195
Mantegazza, L., Poretti, E., and Zerbi, F.M., 1994, *MNRAS*, **270**, 439

The electronically accessible versions (both LaTeX and PostScript) contain the complete paper.

The Editors

COMMISSIONS 27 AND 42 OF THE IAU
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A FLARE EVENT DETECTED IN THE ECLIPSING BINARY CM Dra

CM Dra is an eclipsing binary with the period of $1^{\mathrm{d}}.26838965$ and the inclination angle of $89^{\circ}.82$ (Lacy 1977). It is a very interesting object by two facts. First, it has been currently known as a main-sequence eclipsing double-lined spectroscopic binary with the lowest mass ($0.23\mathrm{M}_{\odot}$ and $0.21\mathrm{M}_{\odot}$; Metcalfe *et al.* 1996). Therefore it offers an excellent opportunity to test the structure and evolution model of very low-mass stars (Metcalfe *et al.* 1996; Chabrier & Baraffe 1995). Second, a planetary occultation with a period about 735^{d} or a submultiple of it was reported in this eclipsing-binary system (Guinan 1996; Martin and Deeg 1996).

In this paper, we present the detection of a flare event from the BVI differential photometry, performing as a part of the TEP (Transits of Extrasolar Planets) international collaboration (Martin et al. 1996). Time-series CCD photometry of CM Dra has been carried out for eight nights from January 20 to March 5, 1997 (Table 1). The observations were made with a TEK1024 CCD camera attached to the 1.8m telescope at Bohyunsan Optical Astronomy Observatory (BOAO). The field of view on the CCD image is $5'.8 \times 5'.8$ at the f/8 Cassegrain focus of the telescope. The exposure times were 240 sec, 150 sec and 5 sec for B, V and I filters, respectively.

The preprocessing of CCD images including the overscan correction, the trimming of unreliable subsection, the bias correction and the flat field correction, was made with the IRAF/CCDRED package. We adopted simple aperture photometry to obtain instrumental magnitudes, using the IRAF/DAOPHOT package (Massey & Davis 1992) and applied the classical two-star differential photometry to get differential magnitudes. Two comparison stars ($V=14^{\mathrm{m}}.2$, $B-V=1^{\mathrm{m}}.1$ for C1; $V=14^{\mathrm{m}}.9$, $B-V=0^{\mathrm{m}}.6$ for C2, from our observation) near CM Dra were monitored to check the light variability of CM Dra (Figure 1). The detailed analysis of light variations (Figure 2) for CM Dra will be given in elsewhere (Kim *et al.* 1997).

Table 1. Observation Log

Obs. Date	Start H.J.D.	Obs. Time	Airmass	Phase	Seeing
Jan. 20	2450469.25	$3^{\mathrm{h}}.0$	2.00~1.24	0.394~0.475	$3''.3$
29	478.25	3.5	1.80~1.14	0.482~0.597	2.2
Feb. 1	481.25	2.8	1.72~1.18	0.849~0.924	1.8
2	482.28	2.8	1.48~1.12	0.663~0.754	2.4
3	483.25	3.2	1.64~1.13	0.430~0.535	1.7
16	496.20	0.3	1.79~1.68	0.635~0.646	2.5
19	499.19	4.5	1.83~1.09	0.991~0.139	2.8
Mar. 5	513.12	6.0	2.17~1.07	0.974~0.171	1.8

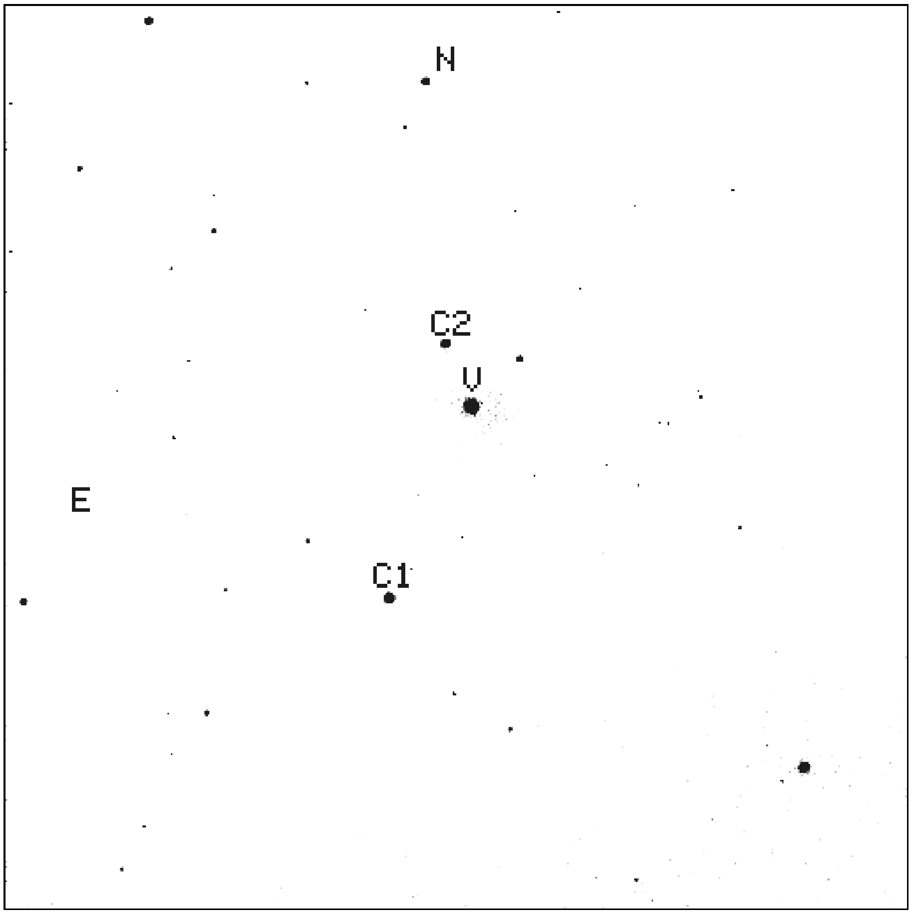

Figure 1. Finding chart of CM Dra. Two comparison stars are denoted as C1 and C2

Peculiar light variations of CM Dra were observed on February 2, 1997 (J.D.2450482.28), from phase 0.66 to 0.72. The brightness increased up to about $0^{\mathrm{m}}.20$ in B and $0^{\mathrm{m}}.06$ in V relative to the normal out-of-eclipse value. This is unlikely to be due to the atmospheric differential extinction because the differences in the airmass among three stars are negligible and their color differences, $\Delta(\mathrm{B}-\mathrm{V})_{V-C1}=0^{\mathrm{m}}.5$ and $\Delta(\mathrm{B}-\mathrm{V})_{C2-C1}=-0^{\mathrm{m}}.5$, are not so large. Considering the brightness change within short time scale of $\sim$1.8 hours and the strong amplitude dependence on colors, it might be a flare as commonly detected in the late-type dwarfs (dMe for CM Dra).

An ultraviolet flare of CM Dra was initially observed by Eggen & Sandage (1967) on June 13, 1966. Its brightness increased by $0^{\mathrm{m}}.7$ in U and U$-$B color changed from $1^{\mathrm{m}}.03$ to $0^{\mathrm{m}}.36$ on short time scale ($\sim$1 min), during the increase of light after mid-eclipse. By carrying out the BVRI high-speed photometry and differential I photometry to detect flare events of CM Dra, Lacy (1977) found only a single flare on May 14, 1976. From this, he estimated the flare rate about less than 0.05 per hour, which is much too low in contrast to that of classical Pop. I flare stars with similar luminosity ($\geq$2 flares/hour; Lacy *et al.* 1976). He suggested that, biased on the abnormally low flare rate and the high space velocity of 163 km/sec, CM Dra might be an evolved system (Pop. II composition). Metcalfe *et al.* (1996) also detected a single flare event from the spectra of CM Dra. In six exposures started from J.D.2446255.666, the emission lines of the primary were observed to be very strong.

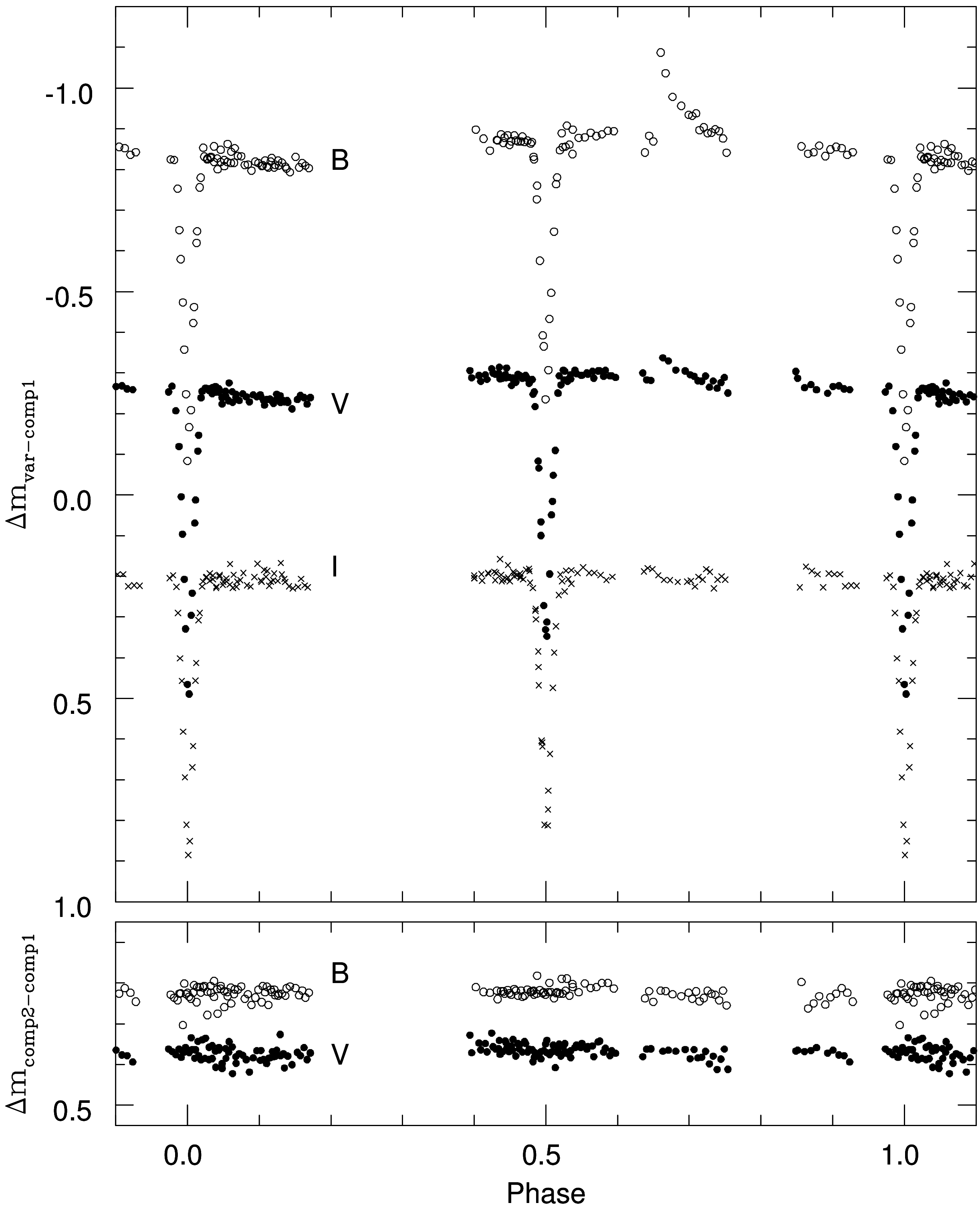

Figure 2. Light variations of CM Dra. A flare event was observed on Feb. 2, 1997, from phase 0.66 to 0.72. The brightness increased by $0^{m}.20$ in B and $0^{m}.06$ in V

Table 2. Flare events of CM Dra

Date(J.D.)	Phase	Duration	Characteristics	Flare rate	Ref
June 13, 1966	eclipse	$1^{h}.25$	$0^{m}.7$ increased in U		1
2442912.87	$\sim$0.93	1.0	$0^{m}.05$ increased in I	$\leq$0.05/hour	2
2446255.66	$\sim$0.39	≥ 1.9	strong emission lines	$\sim$0.02/hour	3
2450482.28	$\sim$0.66	1.8	$0^{m}.20(0^{m}.06)$ increased in B(V)	$\leq$0.04/hour	4

Ref. 1) Eggen & Sandage 1967, 2) Lacy 1977, 3) Metcalfe *et al.* 1996, 4) This paper

The characteristics of four flare events which have been detected in CM Dra are listed in Table 2. The ultraviolet flares of CM Dra might occur in any orbital phase. The brightness during a flare event abruptly increased and decreased on very short time scale of a few minutes (two points of B at the phase of 0.66 in Figure 2). Then its intensity decreased slowly, continuing for 1$\sim$2 hours. Flare rate estimated in this paper is $\leq$0.04 flares per hour, which is consistent with the other data. This low flare rate supports Lacy's (1977) suggestion that CM Dra might be a Population II star.

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A NEW SUSPECTED VARIABLE IN PISCES

We report here of the finding of few brightenings of a star in the neighbourhood of the irregular variable RZ Piscium. We became aware of this behaviour during brightness estimates of RZ Psc on sky patrol plates of the plate stacks of the Harvard College Observatory (Cambridge, MA, U.S.A.).

The presumed new variable was visible on only few plates. Normally the magnitude of the object in question was below the limiting magnitude of the sky patrol plates.

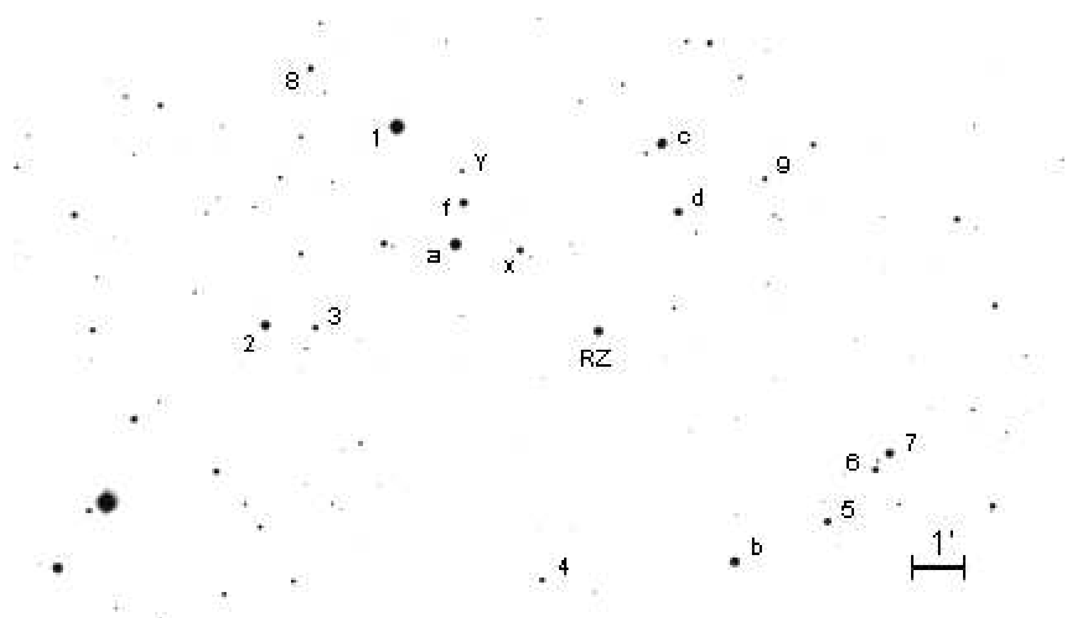

Figure 1. Identification map for the presumed variable (Y) in the neighbourhood of RZ Psc (RZ). Comparison stars are marked, too. Their B-magnitudes are listed in Table 1. The map covers an area of 26' × 17' North is on the top and east to the left. The map is based on a B plate obtained by R. Ziener, KSO, Tautenburg

Plate flaws can be practically excluded as an explanation for the sporadically appearing object since we found at the exact position of it a faint star on a CCD image taken with the 90-cm telescope of the Großschwabhausen (GSH) observing station of the Jena University Observatory. Independently, we identified the star on prints of the Palomar Observatory Sky Survey as well as on Schmidt plates in the plate archive of the Karl- Schwarzschild-Observatory (KSO), Tautenburg.

Table 1. B-magnitudes of the comparison stars

Comparison star	B (mag)	Comparison star	B (mag)
a	11.42	3	14.49
b	12.28	4	14.84
c	12.44	5	13.86
d	12.95	6	14.00
f	13.15	7	12.76
x	14.08	8	14.34
1	10.12	9	15.38
2	12.25		

Table 2. Brightnesses of star Y

Julian Date	Brightness (mag)	Remarks
2427683.797	14.86	Harvard Obs., B
2427692.805	14.86	Harvard Obs., B
2427736.702	12.44	Harvard Obs., B
2433237.500	≈ 14.5	Harvard Obs., B
2443417.368	≈ 15.7	KSO, Tautenburg B
2443417.380	≈ 15.3	KSO, Tautenburg V
2443417.392	≈ 14.9	KSO, Tautenburg R
2443840.292	≈ 16.1	KSO, Tautenburg B
2450347.421	16.17	GSH, CCD, B

The identification map (Figure 1) covers only a part of that map for RZ Psc published by Friedemann et al. (1995). In the map presented here the object in question, RZ Psc, and the comparison stars are marked. Their B magnitudes have been derived on the blue CCD images obtained by us using photometric standard stars measured by Pugach and Kovalchuk (1983) and Wenzel (1993). The relevant photometric data are compiled in Table 1. The mean r.m.s. error amounts to ± 0.06 mag.

The data of the few discovered brightenings are collected in Table 2. The estimated photometric uncertainties amount to $\Delta m \approx \pm 0.2$ mag.

Additional information have been obtained by measuring the brightness of the star on B, V and R plates of the KSO. For this aim we used for the comparison stars B and R magnitudes from the USNO-SA1.0 catalogue by Monet et al. (1996) and V from the Guide Star Catalog 1.1 (1992). From the three KSO plates obtained at JD 2443417 we derived B, V and R magnitudes amounting to 15.7, 15.3, and 14.9, respectively. Combination of the B, V and R data results in a colour index $(B-V) \approx 0.4$ mag and $(V-R) \approx 0.4$ mag. These values correspond to an unreddened star of spectral type F2 to F8.

Taking the brightenings found (see Table 2) as representative, the amplitude of the light variation amounts to $\Delta m_B \approx 3.7 \pm 0.4$ mag. The amplitude derived from the few existing photometric data and the distribution of the brightenings over the time are compatible with the assumption that the variable probably belongs to the class of U Geminorum stars.

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DETECTION OF FAST FLARES OF EV Lac IN 1994–96

Spiky type very short flares of a duration less than 1 sec of some flare stars have been detected (Zalinian, Tovmassian, 1987; Tovmassian, Zalinian, 1988) by observations made with the two-channel (U and B) fast photometer of the Byurakan Astrophysical Observatory (Zalinian, Tovmassian 1989). Fast flares of a total duration of a few seconds or less have been found also by Tsvetkov et al. (1986) and Shvartsman et al. (1988).

In the present contribution we report on the results of the monitoring of EV Lac, that was carried out with the 40 cm telescope of the Byurakan Observatory in 1994-96 with somewhat modified mode of observations. In the present observations the monitoring was done as before with 0.1 sec integration time, but counts in U and B were recorded with an integration time of 10 sec, until the current count in U jumped above the mean value of the preceding hundred counts by 5σ. Then the signal in both channels was recorded with 0.1 sec integration time. Hence the fast, spiky type flares were recorded with 0.1 sec integration time, whilst the relatively slowly rising usual flares were recorded with 10 sec integration time. After each 15-20 min the star was moved out from the diaphragm, and the sky background was recorded for 20-30 sec. In these observations both components of the double fell in the diaphragm of the photometer. As usually in the case of observations of flare stars the ΔU and ΔB magnitudes were determined by the ratio I/I_0, where I_0 is the intensity of the star in its quiescent state. Since observations were done simultaneously in U and B, we measured also U$-$B values for the star during the flare.

Observations were done during 25 hours. Twelve flares were detected. The total duration 4 of half of them is less than 1 sec. In consecutive columns of the Table the following data on the detected flares are presented: date of observation, UT at the maximum of the flare, designation of separate maximums "s" for relatively slow flares), ΔU and ΔB magnitudes of the flare, U$-$B color of the star at the flare maximum, rising time tr of the flare in seconds, and total duration of the flare. In deducing the parameters of the detected flares we accepted the following photometric data for EV Lac AB: V=10.05, B$-$V=1.37, U$-$B=0.75 (Moffet 1974). The ΔU amplitudes and U$-$B colors of flares were estimated by using the light curves of flares smoothed by medians.

Light curves of some flares are shown in Figures 1-3. In Figure 3a the light curve integrated in 10 sec is shown. The record of the short flare that occurred after the main one is shown in Figure 3b with an integration time of 0.1 sec.

We would like to draw attention that very short spiky flares of a total duration less than 1 sec seem mainly to occur shortly after the longer lasting flares.

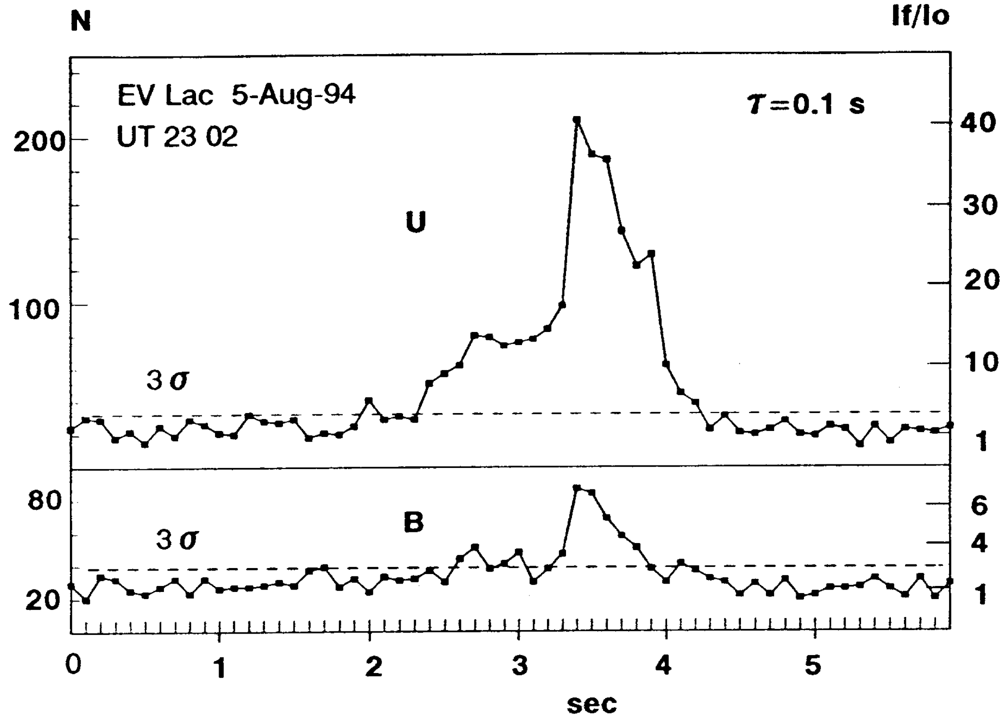

Figure 1

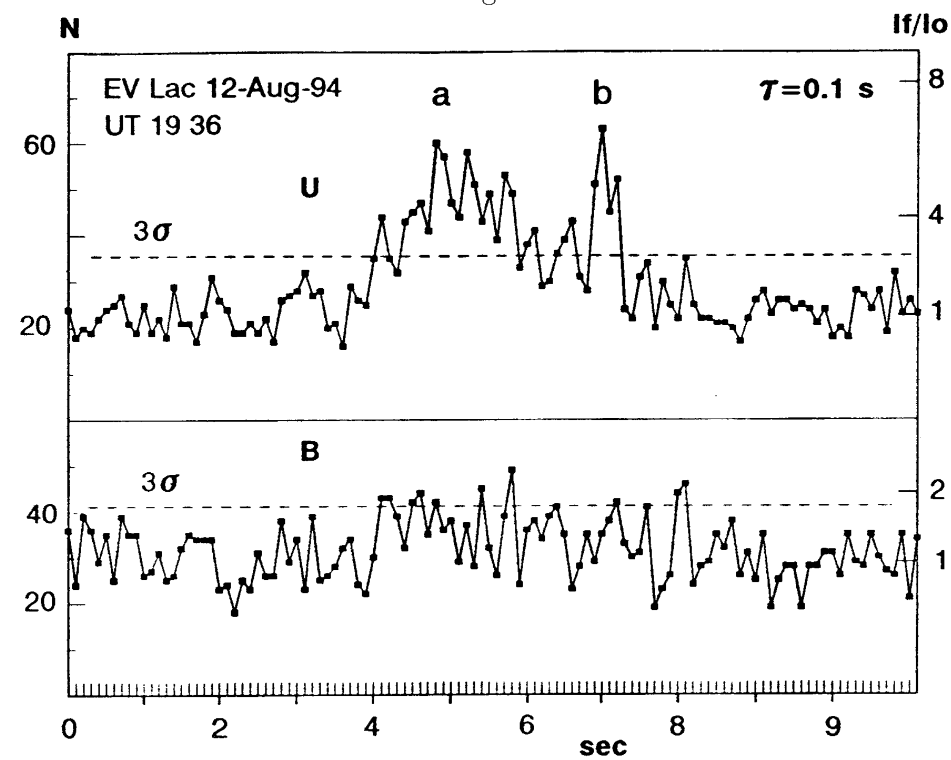

Figure 2

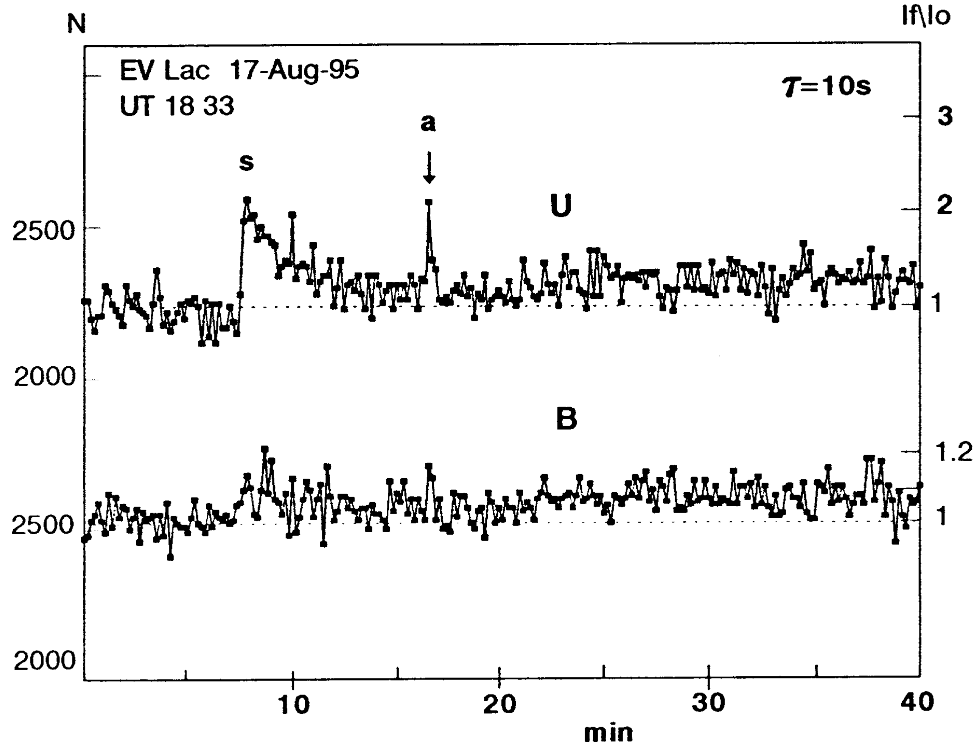

Figure 3a

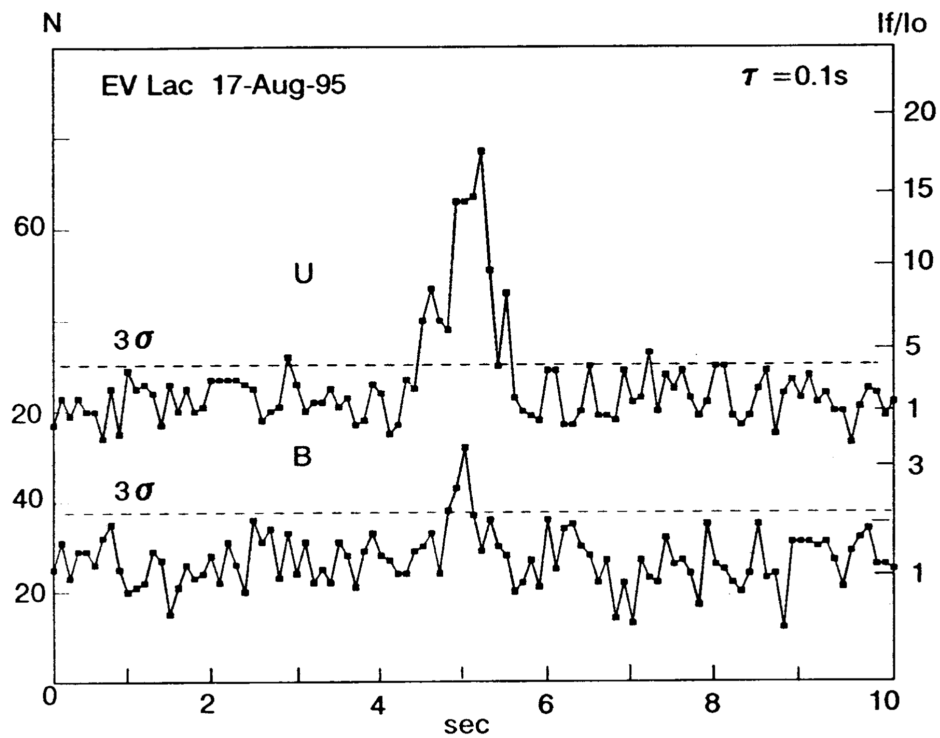

Figure 3b

Table 1. Data on flares of EV Lac

Date	UT max h m	Peaks	ΔU	ΔB	U−B	t_r sec	Duration
4 Aug 94	22 13	s	0.7	0.2	0.2	20	3.5 m
		a	2.2	1.1	−0.3	0.1	0.4 s
5 Aug 94	23 02		4.0	1.9	−1.3	0.2*	2.0* s
7 Aug 94	23 43		2.2	1.2	−0.2	0.2	0.3 s
7 Aug 94	23 59		2.7	1.2	−0.7	0.2	0.3 s
8 Aug 94	00 17	s	1.3	0.4	−0.1	30	6.5 m
12 Aug 94	19 36	a	1.8	0.5	−0.5	0.8	2.4 s
		b	2.0	0.5	−0.7	0.2	0.5 s
17 Aug 95	18 33	s	0.8	0.3	0.3	20	10.0 m
		a	2.9	1.2	−1.0	0.8	1.2 s
17 Sep 96	00 34	a	1.7	0.7	−0.2	0.1	0.8 s
		b	1.2	0.4	−0.1	0.2	0.2 s

* Not certain

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OBSERVATIONS OF FLARE STARS EV Lac, V577 Mon AND YZ CMi

Observations of some flare stars made with the 40 cm telescope of the Byurakan Astrophysical Observatory by using the two-channel (U and B) fast photometer (Zalinian, Tovmassian, 1989) with 0.1 sec integration time allowed to detect very short flares of a duration of a few tenths of a second with rising times of 0.1 sec or perhaps less (Zalinian, Tovmassian, 1987; Tovmassian, Zalinian 1988). Short flares of an order of a few seconds were detected also by Tsvetkov et al. (1986) and Shvartsman et al. (1988).

In this communication we present the results of observations of flare stars EV Lac, V577 Mon and YZ CMi made with the two-channel photometer of the Byurakan Observatory. Observations were made with the 1 m telescope of the IA UNAM in Tonantzintla in November and December 1996, and with the 2.1 m telescope of the INAOE in Cananea in December 1996 and January 1997 (Mexico). Two photomultipliers EMI 9789 AQ were used in the photometer.

Depending on the size of the telescope and on the observing conditions (night sky brightness, brightness of the Moon) different integration times of 0.5, 0.1 and 0.05 sec have been used. In each 15-20 min the sky background was recorded for 20-30 sec. During the monitoring the obtained information has been recorded in the memory of a PC.

The U and B magnitudes of the observed stars during the flare were determined by comparison with their corresponding values in the quiescent state. In this run just the flaring component of the double star EV Lac was observed. The observations lasted during 12.43 hours with the 1 m telescope and 3.2 hours with the 2.1 m telescope. V 577 Mon was observed during 3.25 hours with the 1 m telescope and 3 hours 15 min with the 2.1 m telescope. YZ CMi was observed during 0.75 hours only with the 2.1 m telescope. Nine flares of EV Lac, and five flares of V 577 Mon were detected in these observations. No flare of YZ CMi was detected. Sometimes the flares are composite, and short, spiky flares are observed over, or immediately after the main, relatively slow flare.

The data on the observed flares of EV Lac is summarized in Table 1, and that of the V577 Mon in Table 2. For deducing the parameters of the observed flares it was accepted that U and B magnitudes of the flaring component of EV Lac are equal to $12^{m}_{.}79$ and $11^{m}_{.}81$ respectively (Alekseev, Gershberg 1995), and that of V577 Mon are equal to $14^{m}_{.}0$ and $12^{m}_{.}8$ (Shvartsman et al. 1988). In consecutive columns of both Tables the following information is given: the date of observation, UT at the maximum of flare, the designation of separate peaks observed during one flare, ΔU and ΔB magnitudes of the flare, U−B color of the star at the flare maximum, the rising time of the flare t_r, the full duration of the flare, the integration time of observation, and the telescope, with which the observation was made. For determining the parameters of flares the smoothed by medians light curves of flares were used.

Table 1. Data on flares of EV Lac

Date	UT max h m	Peaks	ΔU	ΔB	U−B	t_r sec	Duration sec	τ sec	Tel m
16 Nov 96	22 12.2		1.3	0.6	0.3	2.0	4.0	0.5	1.0
19 Nov 96	22 24.0		2.2	0.7	−0.5	1.5	4.0	0.5	1.0
22 Nov 96	22 35.9		1.5	0.8	0.3	0.5	2.5	0.5	1.0
24 Nov 96	22 43.8	a	0.8	0.4	0.6	13.0	44.0	0.5	1.0
		b	1.2	0.6	0.4	0.5	1.	5	
04 Dec 96	23 23.2	a	0.8	0.4	0.6	12.0	45.0	0.5	1.0
		b	0.9	0.3	0.4	0.5	1.0		
30 Jan 97	02 14.6	slow	0.4	0.1	0.7	41*	150.0	0.05	2.1
		spike	0.7	0.1	0.4	<1.0	<1.0*		

* Not certain

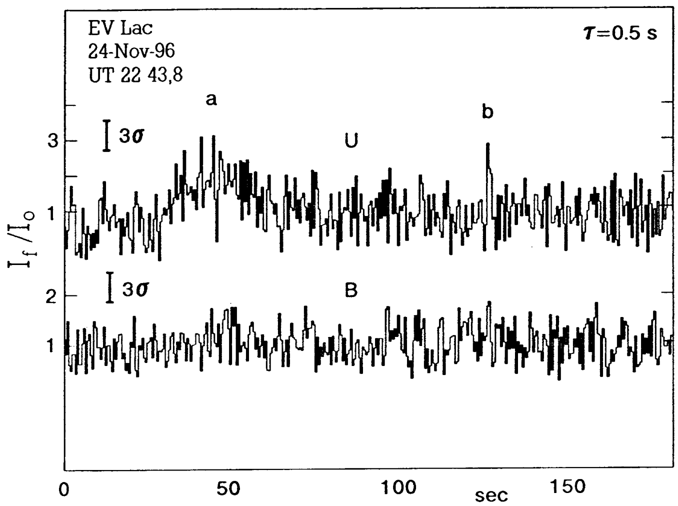

Figure 1

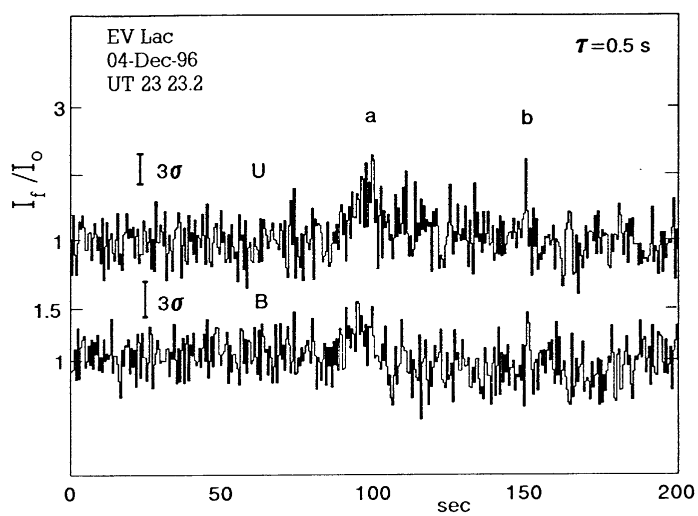

Figure 2

Table 2. Data on flares of V577 Mon

Date	UT max h m	Peaks	ΔU	ΔB	U−B	t_r sec	Duration sec	τ sec	Tel m
10 Jan 97	04 23.7		1.1	0.4	0.5	1.7	4.0	0.1	2.1
10 Jan 97	05 57.5		2.5	0.9	−0.4	5.0*	30.0	0.1	2.1
10 Jan 97	06 10.8	a	0.6	0.0	0.6	8.0	40.0	0.1	2.1
		b	1.8	0.8	0.2	0.1	0.3	0.1	
10 Jan 97	07 27.0		1.2	0.0	0.0	0.5	1.5	0.1	2.1

* The small preflare (Figure 4) is not considered.

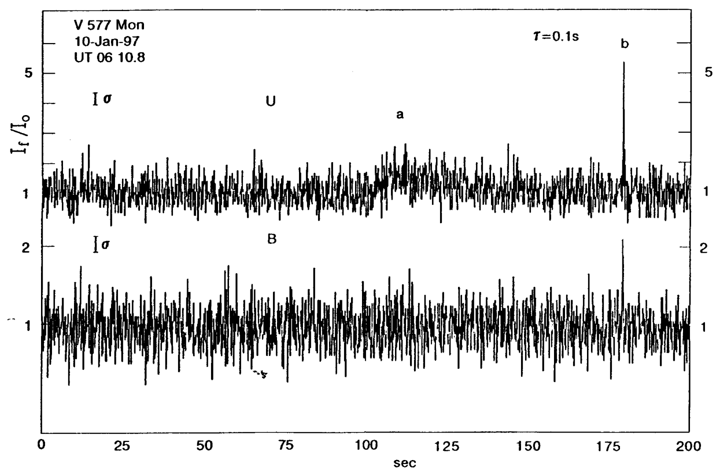

Figure 3

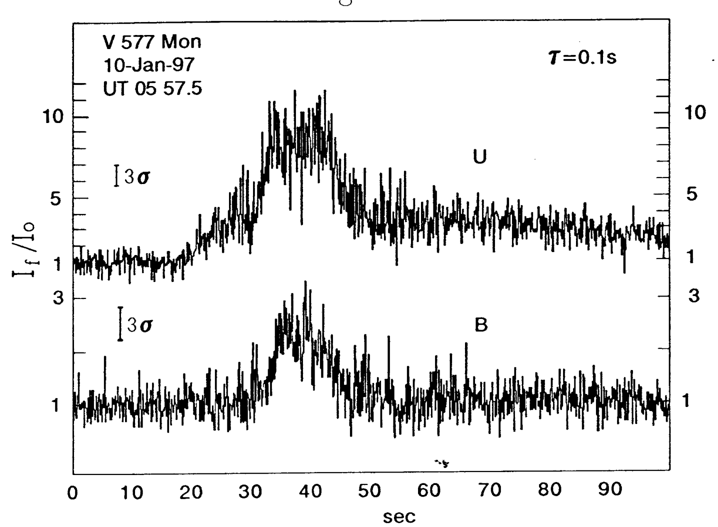

Figure 4

Light curves of some flares are shown in Figures 1-4. The spiky type short flares of a duration less than 1 sec observed simultaneously in U and B are very remarkable (Figures 1-3). Such spiky flares were also detected in previous observations with the two-channel fast photometer (Tovmassian, Zalinian, 1988; Zalinian, Tovmassian, 1997). A chance coincidence of two noise spikes on two independent records in U and B with values of counts exceeding 5σ may take place once in 3×10^4 hours. Thus the observed spikes are real flares. Shvartsman et al. (1988) stated that they have not detected flares with duration less than 2-3 sec, though on the light curves demonstrated by them there are some very short spikes similar to flares detected by us. We may suggest that Shvartsman et al. assumed that such spikes, registered at only one waveband, were only noise, and for this reason were not considered by them as real flares. The existence of such flares put certain constrains on the theories of the origin of stellar flares.

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SA98-185(=HD 292574) - A NEW ECLIPSING BINARY AMONG LANDOLT'S STANDARD STARS

We present observational results of a newly discovered eclipsing binary SA98-185 (=HD 292574, $RA_{2000} = 6^{h}52^{m}01^{s}.85$, $DEC_{2000} = -00°27'21''.7$, A2). It is one of well observed stars in the Landolt's (1983, 1992) standard star list, being widely used in the UBVRI photometry (for examples, Menzies *et al.* 1991 and Richer *et al.* 1985).

During the observing runs at Siding Spring Observatory (SSO) from November 5, 1996 to March 4, 1997, abnormal data points of SA98-185 were detected on February 28, 1997 (HJD2450508.07) for the first time. The brightness decreased by $\sim 0^{m}.06$ in the B, V, I magnitudes relative to that of the other standard stars (see Figure 2, upper panel). The field of view of SSO 40″ telescope ($f/8$) with SITe 2048 × 2048 CCD is $20'.6 \times 20'.6$ and covers the whole area of SA98 which contains many well observed standard stars.

We carried out time-series CCD observations of SA98-185 over four nights from March 13 to 29, 1997 at the Bohyunsan Optical Astronomy Observatory (BOAO) in order to detect its light variability. These observations were done with a TEK1024 CCD camera attached to the BOAO 1.8m telescope. The field of view in the CCD image is $5'.8 \times 5'.8$ at the f/8 Cassegrain focus of the telescope. Three comparison stars (SA98-193, 666 and 688; see Table 1) were monitored to check the light variability of SA98-185 (Figure 1).

The CCD preprocessings such as bias subtraction and flat fielding were made with the IRAF/CCDRED package. We adopted simple aperture photometry to obtain instrumental magnitudes, using the IRAF/DAOPHOT package (Massey & Davis 1992) and transformed to the standard system as follows:

$$B(V) = b(v) + a_1 + a_2 \times X + a_3 \times (B - V) + a_4 \times (B - V) \times X$$

where $B(V)$ and $b(v)$ are standard and instrumental magnitudes and X is the airmass. Four coefficients of a_1, a_2, a_3 and a_4 are zero level, primary extinction, color and secondary extinction term, respectively. We then obtained differential magnitudes of SA98-185 which are plotted in Figure 2 and listed in Table 2 (ΔB and ΔV in the sense Var–C1, ΔI in the sense of Var–C2).

Table 1. Photometric properties of observed stars (Landolt, 1992)

ID_{ours}	Star Name	V	B−V	U−B
Var	SA98-185	10.536	0.202	0.113
C1	SA98-193	10.030	1.180	1.152
C2	SA98-666	12.732	0.164	−0.004
C3	SA98-688	12.754	0.293	0.245

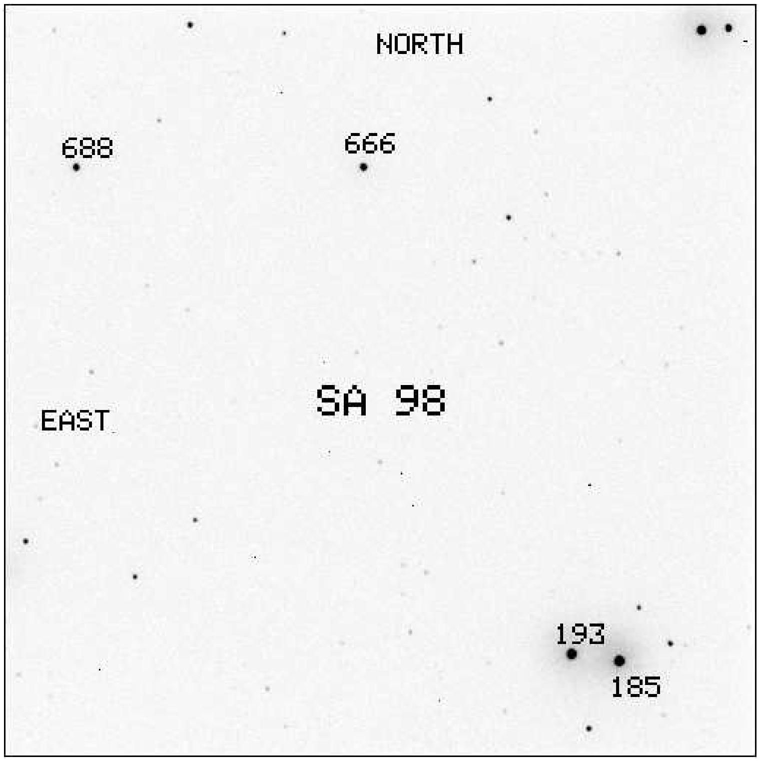

Figure 1. A CCD frame (5.′8 × 5.′8) of SA98-185 observed in the BOAO. Three comparison stars (SA98-193, 666 and 688) are denoted by their number

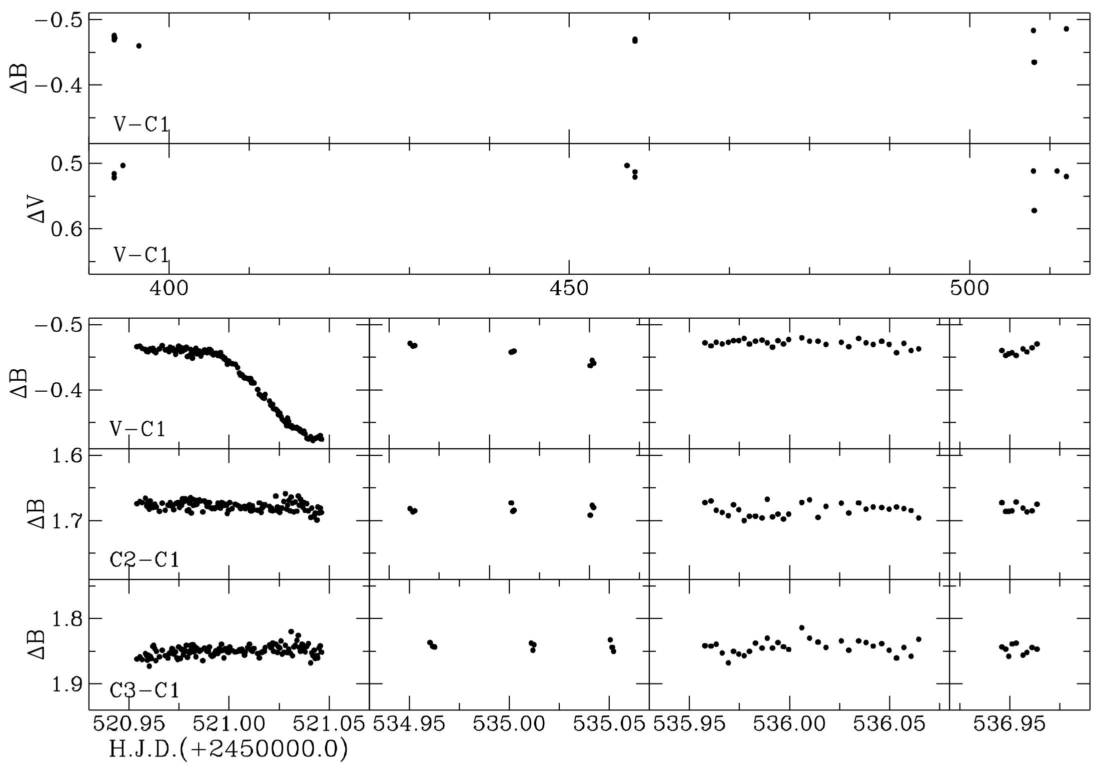

Figure 2. Light variations of SA98-185 observed at SSO (upper panel) and BOAO(lower panel). It is noted that the brightness of SA98-185 decreased by about $0^{m}.06$ in B and V near HJD 2450508.07 and by $0^{m}.14$ in B near HJD 2450521.04

Table 2. Differential magnitudes of SA98-185

HJD	Δ B	HJD	Δ B	HJD	Δ B	HJD	Δ V	HJD	Δ I
2450000.+		520.9896	−0.459	521.0369	−0.334	2450000.+		2450000.+	
393.1518	−0.469	520.9902	−0.462	521.0374	−0.336	393.1430	+0.522	393.1231	−2.215
393.1547	−0.476	520.9909	−0.460	521.0380	−0.333	393.1456	+0.522	393.1255	−2.223
393.1577	−0.473	520.9915	−0.455	521.0389	−0.326	393.1487	+0.516	393.1303	−2.238
393.2190	−0.472	520.9921	−0.454	521.0396	−0.325	394.2323	+0.503	393.1328	−2.236
393.2219	−0.472	520.9928	−0.455	521.0401	−0.331	457.2027	+0.503	393.1366	−2.207
396.2363	−0.460	520.9934	−0.456	521.0407	−0.328	458.1895	+0.521	393.1390	−2.240
458.2010	−0.467	520.9943	−0.453	521.0413	−0.325	458.1919	+0.513	393.2301	−2.230
458.2034	−0.470	520.9951	−0.453	521.0419	−0.323	507.9734	+0.512	393.2326	−2.235
507.9708	−0.483	520.9957	−0.457	521.0425	−0.325	508.0717	+0.572	394.2025	−2.223
508.0690	−0.435	520.9962	−0.451	521.0430	−0.326	510.9329	+0.512	396.2302	−2.209
512.0770	−0.486	520.9968	−0.451	521.0438	−0.327	512.0799	+0.520	457.2037	−2.203
520.9539	−0.466	520.9974	−0.448	521.0443	−0.328	534.9655	+0.503	458.1924	−2.220
520.9554	−0.467	520.9980	−0.448	521.0449	−0.327	534.9661	+0.512	458.1947	−2.204
520.9565	−0.464	520.9986	−0.445	521.0455	−0.330	534.9664	+0.513	507.9776	−2.221
520.9581	−0.462	520.9991	−0.439	521.0461	−0.325	535.0140	+0.516	508.0757	−2.162
520.9587	−0.459	520.9997	−0.444	534.9604	−0.471	535.0155	+0.520	508.9356	−2.233
520.9591	−0.458	521.0003	−0.441	534.9618	−0.467	535.0159	+0.517	509.0682	−2.221
520.9596	−0.458	521.0015	−0.440	534.9627	−0.468	535.0530	+0.521	510.9347	−2.225
520.9601	−0.460	521.0030	−0.439	535.0109	−0.458	535.0540	+0.523	511.0626	−2.203
520.9605	−0.463	521.0042	−0.434	535.0118	−0.459	535.0544	+0.522	511.9300	−2.247
520.9612	−0.462	521.0051	−0.426	535.0124	−0.460	535.9592	+0.497		
520.9619	−0.463	521.0058	−0.422	535.0504	−0.437	535.9621	+0.507		
520.9623	−0.460	521.0064	−0.423	535.0514	−0.445	535.9649	+0.504		
520.9628	−0.460	521.0070	−0.420	535.0521	−0.441	535.9677	+0.503		
520.9633	−0.457	521.0076	−0.418	535.9577	−0.472	535.9707	+0.499		
520.9637	−0.459	521.0081	−0.418	535.9608	−0.467	535.9733	+0.504		
520.9652	−0.463	521.0093	−0.418	535.9634	−0.473	535.9759	+0.502		
520.9666	−0.468	521.0102	−0.416	535.9663	−0.470	535.9785	+0.497		
520.9681	−0.461	521.0107	−0.418	535.9694	−0.473	535.9815	+0.497		
520.9694	−0.462	521.0112	−0.411	535.9720	−0.476	535.9843	+0.506		
520.9700	−0.458	521.0117	−0.413	535.9747	−0.476	535.9874	+0.504		
520.9705	−0.465	521.0123	−0.410	535.9773	−0.479	535.9902	+0.499		
520.9710	−0.463	521.0143	−0.401	535.9800	−0.470	535.9928	+0.510		
520.9714	−0.463	521.0151	−0.393	535.9830	−0.475	535.9955	+0.504		
520.9719	−0.464	521.0160	−0.392	535.9862	−0.477	535.9982	+0.504		
520.9723	−0.461	521.0165	−0.389	535.9889	−0.472	536.0009	+0.505		
520.9732	−0.454	521.0170	−0.388	535.9915	−0.466	536.0037	+0.507		
520.9738	−0.461	521.0175	−0.387	535.9942	−0.475	536.0081	+0.517		
520.9743	−0.461	521.0180	−0.393	535.9969	−0.470	536.0120	+0.509		
520.9748	−0.467	521.0202	−0.383	535.9996	−0.477	536.0161	+0.504		
520.9752	−0.462	521.0207	−0.377	536.0024	−0.476	536.0200	+0.505		
520.9757	−0.458	521.0212	−0.377	536.0061	−0.480	536.0238	+0.507		
520.9762	−0.465	521.0217	−0.378	536.0100	−0.474	536.0275	+0.505		
520.9767	−0.459	521.0223	−0.371	536.0142	−0.474	536.0317	+0.510		
520.9772	−0.463	521.0233	−0.370	536.0182	−0.469	536.0363	+0.507		
520.9776	−0.462	521.0241	−0.367	536.0258	−0.473	536.0400	+0.512		
520.9781	−0.462	521.0247	−0.362	536.0296	−0.466	536.0441	+0.499		
520.9786	−0.465	521.0253	−0.364	536.0345	−0.478	536.0479	+0.518		
520.9792	−0.451	521.0259	−0.359	536.0382	−0.472	536.0516	+0.519		
520.9798	−0.452	521.0265	−0.355	536.0418	−0.470	536.0551	+0.513		
520.9802	−0.452	521.0273	−0.352	536.0461	−0.474	536.0589	+0.522		
520.9807	−0.462	521.0281	−0.350	536.0498	−0.470	536.0626	+0.524		
520.9811	−0.455	521.0287	−0.345	536.0534	−0.457	536.0663	+0.530		
520.9816	−0.449	521.0292	−0.357	536.0571	−0.471	536.9469	+0.534		
520.9820	−0.460	521.0298	−0.351	536.0608	−0.460	536.9487	+0.530		

Table 2 (cont.)

HJD	Δ B	HJD	Δ B	HJD	Δ B	HJD	Δ V
2450000.+		520.9896	−0.459	521.0369	−0.334	2450000.+	
520.9825	−0.456	521.0304	−0.344	536.0645	−0.462	536.9502	+0.523
520.9830	−0.462	521.0310	−0.345	536.9461	−0.460	536.9519	+0.524
520.9834	−0.464	521.0316	−0.342	536.9480	−0.453	536.9548	+0.522
520.9839	−0.455	521.0324	−0.342	536.9495	−0.456	536.9577	+0.516
520.9851	−0.459	521.0330	−0.341	536.9512	−0.457	536.9598	+0.513
520.9859	−0.452	521.0338	−0.343	536.9532	−0.452	536.9626	+0.510
520.9868	−0.457	521.0346	−0.340	536.9566	−0.463	536.9643	+0.514
520.9877	−0.461	521.0351	−0.340	536.9586	−0.458		
520.9883	−0.461	521.0357	−0.337	536.9612	−0.465		
520.9890	−0.457	521.0363	−0.337	536.9636	−0.470		

Light variations of SA98-185 were clearly detected on one night (HJD 2450521.0). Its brightness started decreasing at HJD 2450520.99, then reached minimum near HJD 2450521.042 and then slightly increased again (Figure 2). The light curves are similar to that of an Algol-type eclipsing binary (Hoffmeister *et al.* 1985). Its binary nature can be also deduced from the SSO data which showed a similar brightness decrease of about $0\overset{m}{.}06$ in all filters (B, V and I).

Light variations of SA98-185 have not been reported before (Kholopov *et al.* 1988). The UBVRI photometry performed by Landolt (1992) for 37 nights (45 data points) did not show any peculiarity of SA98-185 and gave very low mean errors of magnitudes and colors (for example, $V=10.536\pm0.0018$). However, our observations suggest that it is a detached eclipsing binary with a minimum brightness near HJD 2450521.042, and an amplitude of at least $0\overset{m}{.}14$ in the blue band.

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ERRATUM

In the printed version the affiliation for author S.-G. LEE was erroneously given as "3".

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SORTING OUT W BOOTIS AND ITS COMPARISON STARS

W Bootis (HR 5490, HD 129712, V $\sim$ 4.81, SpT M3 III) is a bright example of a small-amplitude red variable. Percy & Desjardins (1996) recently reported that W Boo had changed period in about 1990, from 25 days to 50 days, and suggested that W Boo had switched pulsation mode. Unfortunately, the check star (HD 130446) used in the differential photometry appeared to be slightly variable. A second check star (HR 5524, HD 130603) was adopted, but it too appeared to be slightly variable. We therefore decided to observe all three stars in 1996, relative to the original comparison star, and a new check star. We report the results here.

The comparison star was HR 5534 (HD 130948, V = +5.85, B−V = +0.56, SpT G0-2 V) and the new check star was HR 5454 (HD 128402, V = +6.41, B−V = +1.1, SpT K0). Five observers (Beresky, Luedeke, Smith, Thompson, Wood) carried out the measurements as part of the American Association of Variable Star Observers (AAVSO) photoelectric photometry program (Landis et al. 1992). The observations were made and reduced as described there, and in Percy & Desjardins (1996).

We have a total of 48 V observations of W Boo (and its comparison and new check star), 23 observations of HD 130446, and 25 observations of HR 5524. The standard deviation of the (new check – comparison) magnitudes is $\sigma = 0.011$, which is the expected error of the observations, especially considering that they were made by five different observers. These stars therefore appear to be constant. The σ of the (HR 5524 – comparison) magnitudes is 0.010, which suggests that this star is also constant.

The σ of the (HD 130446 – comparison) magnitudes is 0.020, which suggests that this star may be slightly variable. It is also possible that the larger scatter is due to the faintness (V = 7.6) of the star. The power spectrum of the previous observations of this star (Percy & Desjardins 1996) showed a peak at 0.1277 cycle/day, but this peak does not appear in the power spectrum of the present observations, nor does it produce a reasonable phase diagram. There are several peaks in the power spectrum of the present observations, none of which is very conspicuous. The star is K0 III type, so the variability, if real, could be due to star spots. Hatzes & Cochran (1996) have recently reported short-term radial velocity variations in K giants, which they attribute to pulsation.

The 1996 light curve of W Boo (Figure 1) is very interesting. The cycle count period is 24 days (very similar to the period of W Boo before 1990), but it is strongly modulated, and there is some evidence for long-term variations. The light curve can be well represented as the superposition of two periods - 25 and 33 days. Periods of 25, 35 and 50 days were found by Percy & Desjardins (1996), and interpreted as adjacent radial modes. The new 25- and 33-day periods were determined independently of the previously-known periods. The mode switching in W Boo is rather similar to that recently reported in RR UMi by Lloyd & West (1996). This star switched between periods of 34 and 61 days, with strong modulation of the amplitude.

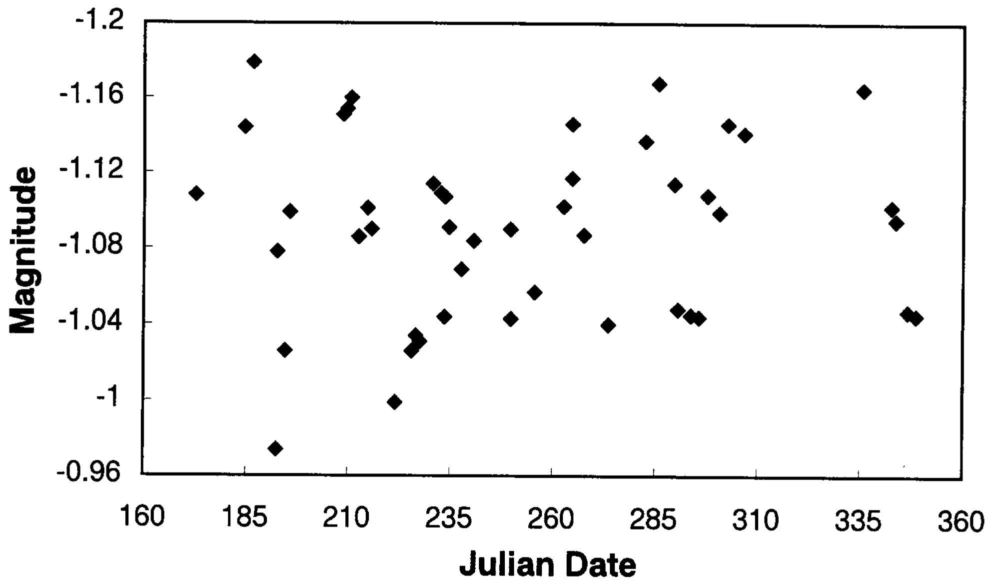

Figure 1. The 1996 V light curve of W Boo, relative to the comparison star HR 5534. The time axis is (JD - 2450000). Note the modulation in the amplitude of the pulsation; the light curve can be represented as the superposition of 25- and 33-day periods

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IMPROVED EPHEMERIS AND NEW OBSERVATIONS OF NSV 02980

NSV 02980 (S 03990, CSV 00076, GSC 0141.0638) was originally announced as a variable star by Hoffmeister (1949). Additional observations carried out by Guarro-Flo et al. (1995) showed that NSV 02980 is in fact a W UMa-type eclipsing binary system. The following preliminary ephemeris was given:

$$\text{Min. I} = \text{HJD}\,2449800.429 + 0\overset{\text{d}}{.}41630 \times E$$

To improve the above ephemeris and its light curve, NSV 02980 was observed in integral light and in the B and V bands during several nights, from December 29, 1995 to January 17, 1997, using the 0.32-m Ritchey-Chretien telescope (Moschner) and the 0.20-m SC-telescope (Kleikamp) equipped with ST-6 cameras, at private observatories in Germany, and the 0.51-m telescope at l'Ametlla del Valles Observatory, in Spain, equipped with a Starlight Xpress CCD camera. GSC 0141.0390 and GSC 0141.0666 were used as comparison and check stars respectively.

From the new set of data a list of minima were derived using the Kwee and van Woerden (1956) method. These new minima showed that the preliminary period given by Guarro-Flo et al. was an alias one. After performing a least-squares linear fit on the minima the following improved ephemeris was found:

$$\begin{array}{l} \text{Min. I} = \text{HJD}\,2450081.3665 + 0\overset{\text{d}}{.}34451 \times E \\ \qquad\qquad\qquad\qquad \pm 0.0001 \quad \pm 0.00003 \end{array}$$

Table 1

HJD	Epoch	Minimum	Filter	O−C	Observer
2450081.5394	0.5	II	no	0.0007	(1)
2450086.3616	14.5	II	no	−0.0003	(1)
2450086.5331	15.0	I	no	−0.0010	(1)
2450088.4287	20.5	II	no	−0.0002	(1)
2450096.5243	44.0	I	no	−0.0006	(1)
2450102.5542	61.5	II	V	0.0003	(2)
2450116.5057	102.0	I	V	−0.0008	(2)
2450120.4702	113.5	II	V	0.0018	(2)
2450122.5363	119.5	II	V	0.0008	(2)
2450125.4621	128.0	I	V	−0.0017	(2)
2450129.4269	139.5	II	B	0.0012	(2)
2450130.4605	142.5	II	B	0.0013	(2)
2450131.4931	145.5	II	B	0.0004	(2)
2450144.4120	183.0	I	B	0.0001	(2)
2450153.3679	209.0	I	no	−0.0013	(1)
2450154.4033	212.0	I	B	0.0006	(2)
2450155.4349	215.0	I	B	−0.0013	(2)
2450157.3311	220.5	II	no	0.0001	(1)
2450380.5737	868.5	II	no	0.0003	(1)
2450464.4617	1112.0	I	no	0.0001	(3)
2450465.4964	1115.0	I	no	0.0012	(1)

Observer: (1) Moschner, (2) Garrigos, (3) Kleikamp

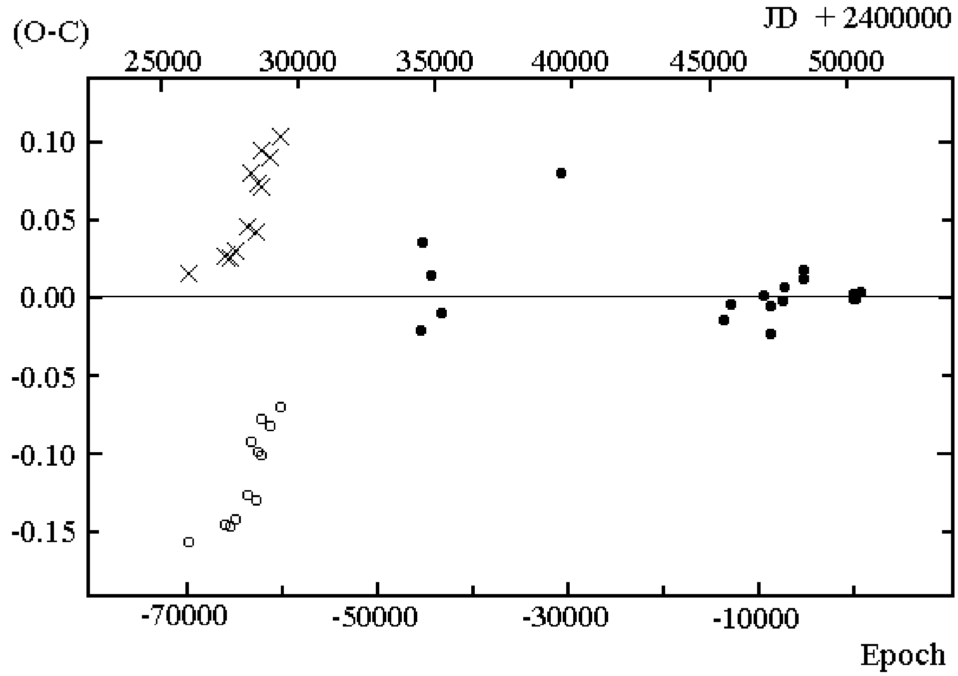

Figure 1

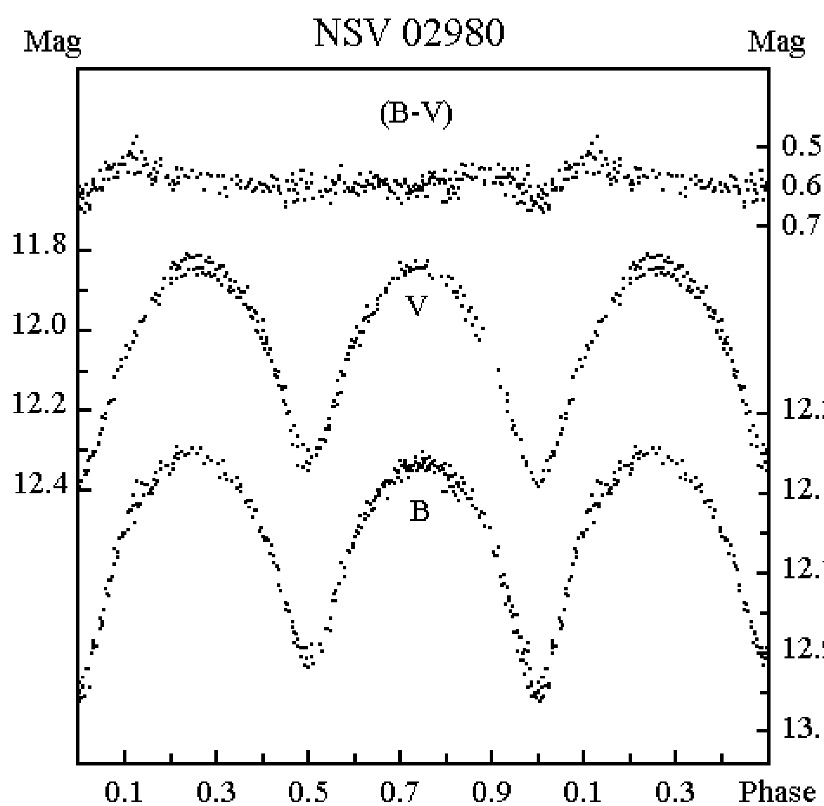

Figure 2

Table 1 summarizes minima timings and O−C residuals according to the new ephemeris.

After computing the improved ephemeris, to obtain a history of the period behaviour of NSV 02980, the variable was investigated (Moschner) on 350 plates taken with the 0.4-m astrograph at Sonneberg Observatory. The variable was found to be at minimum light on 26 plates, covering the interval from January 5, 1930 until January 17, 1991.

Analysis of the timings suggests that the period of NSV 02980 has remained fairly constant from JD 2434391.5 until now. The observational gap between JD 2429302 and JD 2434391 does not allow to ascertain whether the period before JD 2434391 was different from the present one. Figure 1 shows O−C residuals calculated against the new ephemeris. The typical error of photographic measurements is ±0.02 days whereas that of the CCD measurements is ±0.00005 days. Before JD 2434391 it is not possible to unambiguously assign an epoch number. For this reason, Figure 1 shows residuals for the two closest computed epochs to the observed photographic minima before JD 2434391, which are represented by open boxes and crosses. Solid circles represent residuals after JD 2434391. Table 2 lists photographic minima before JD 2434391 and gives the key to Figure 1. Table 3 lists photographic minima after JD 2434391.

Table 2

HJD	Epoch [Open boxes]	Epoch [Crosses]	O−C [Open boxes]	O−C [Crosses]
2425981.5293	−69953.5	−69954.0	−0.1569	0.0154
2427344.5938	−65997.0	−65997.5	−0.1462	0.0261
2427479.4689	−65605.5	−65605.0	−0.1468	0.0255
2427718.5626	−64911.5	−64912.0	−0.1430	0.0293
2428126.4781	−63727.5	−63728.0	−0.1274	0.0449
2428249.3306	−63371.0	−63371.5	−0.0927	0.0796
2428428.6097	−62850.5	−62851.0	−0.1310	0.0413
2428496.5094	−62653.5	−62654.0	−0.0998	0.0725
2428609.3341	−62326.0	−62326.5	−0.1021	0.0702
2428629.3392	−62268.0	−62268.5	−0.0786	0.0937
2428963.3371	−61298.5	−61299.0	−0.0832	0.0891
2429302.3481	−60314.5	−60315.0	−0.0700	0.1023

Table 3

HJD	Epoch	O−C
2434391.4982	−45542.5	−0.0216
2434451.3273	−45369.0	0.0350
2434809.4239	−44329.5	0.0135
2435192.3223	−43218.0	−0.0110
2439500.3383	−30713.5	0.0797
2445397.3933	−13596.0	−0.0152
2445672.4948	−12797.5	−0.0050
2446850.3830	−9378.5	0.0005
2447088.5847	−8687.0	−0.0234
2447099.6266	−8655.0	−0.0059
2447558.5165	−7323.0	−0.0033
2447566.4500	−7300.0	0.0065
2448271.4952	−5253.5	0.0120
2448273.5671	−5247.5	0.0168

Also, observations allowed to obtain a new light curve in the B and V bands. To obtain the B and V magnitudes of the light curve of NSV 02980, the comparison star GSC 0141.0390 was standardized using an OPTEC SSP-5A photoelectric photometer attached to the Cassegrain focus of the 0.6-m telescope at Esteve Duran Observatory (Spain). Results indicate that NSV 02980 is an object with a V magnitude of 11.83 ± 0.03 at maximum I (maximum I is the maximum following the primary minimum), and an average B−V color index of $+0\overset{\mathrm{m}}{.}59 \pm 0\overset{\mathrm{m}}{.}08$. Figure 2 depicts B, V, and B−V phase curves. Table 4 summarizes amplitudes of the primary and secondary minima and maximum light levels in the B and V bands. Systematic differences appearing around Max. I might be due to observational uncertainties.

Table 4

	Max. magnitude	Min. I amplitude	Min. II amplitude
B Band	$12\overset{\mathrm{m}}{.}42 \pm 0.05$	$0\overset{\mathrm{m}}{.}59 \pm 0.04$	$0\overset{\mathrm{m}}{.}50 \pm 0.03$
V Band	$11\overset{\mathrm{m}}{.}83 \pm 0.03$	$0\overset{\mathrm{m}}{.}54 \pm 0.03$	$0\overset{\mathrm{m}}{.}47 \pm 0.04$

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PHOTOMETRIC RESULTS ON THREE HIPPARCOS VARIABLES: THE NEW ECLIPSING BINARY SYSTEMS HD 125488 AND HD 126080, AND THE STAR HD 341508

An analysis of the photometric data from the Tycho Mean Photometric Catalogue and the Tycho Photometric Observations Catalogue performed by Woitas (1997), yielded a list of 43 new bright variables. Several boreal stars of this list were included in the program for the identification and characterization of new variable stars carried out by the Grup d'Estudis Astronomics and the Esteve Duran Observatory. The first objects monitored were HD 125488, HD 126080 and HD 341508.

HD 125488 (= SAO 120401 = PPM 160531 = BD +06°2869 = AGK +06°1704 = GSC 323.930) was observed in the V band for 6 nights, from 13 to 21 March 1997, using a CCD camera and a 6-cm refracting telescope at Esteve Duran Observatory. HD 124929 was used as comparison star, and HD 125452, HD 125322, and GSC 323.1326 as check stars. HD 125488 has an average photovisual magnitude of $7\overset{m}{.}3$ and F2 spectral type. According to Woitas, this object is an RR Lyr variable with a 0.20 day period. Observations show that HD 125488 is not an RR Lyr star but an eclipsing binary system with a period of 0.48 days (Figure 1). The light curve indicates that both minima are almost equally deep, the amplitude being $0\overset{m}{.}37$ in V. There was ambiguity in the selection of the primary minimum, so it was arbitrarily assigned to the best observed minimum. Additional photometric observations should be performed to clarify this point. The following ephemeris was computed:

$$\begin{array}{ll}\text{Min. I} = \text{HJD}\,2450525.6434 & + \; 0\overset{d}{.}48069 \times E \\ \qquad\qquad\qquad\quad \pm 0.0003 & \pm \; 0.00010\end{array}$$

Table 1 gives a list of minimum timings and O−C residuals.

Table 1

HJD	Epoch	Minimum	O−C
2450520.5961	−10.5	II	$-0\overset{d}{.}0001$
2450525.6434	0.0	I	0.0000
2450526.6051	2.0	I	0.0003
2450528.5274	6.0	I	−0.0001

A preliminary analysis suggests that the mass ratio of the components in this binary system is close to 1, the minima are due to partial occultations, and than the fill out factor f is bigger that 0.25.

HD 126080 (= SAO 45017 = PPM 54091 = BD +42°2486 = AGK3 +41°1245 = GSC 3038.0566) was observed in the V band for 16 nights, from 12 March to 13 April 1997, at Mollet del Valles Observatory, using also a CCD camera and a 6-cm refractor. It is

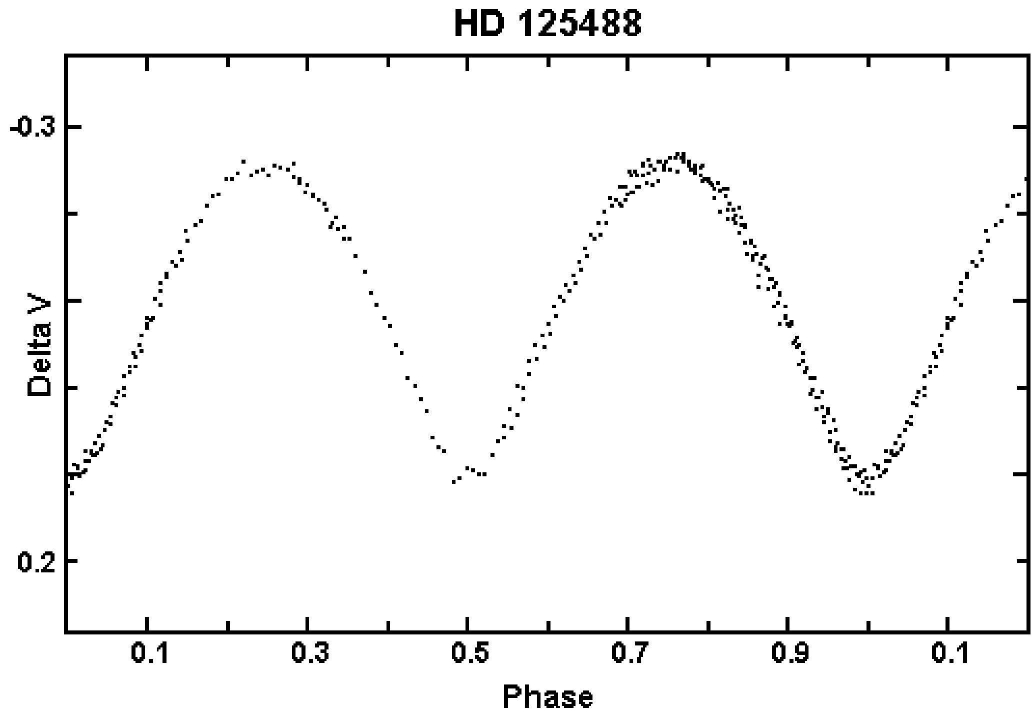

Figure 1

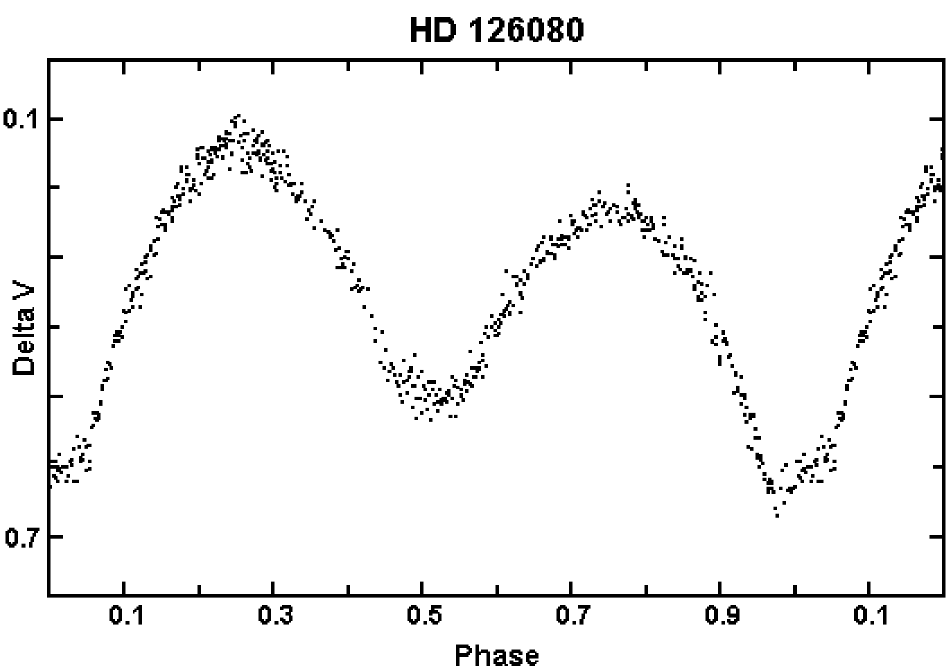

Figure 2

an object with an average photovisual magnitude of $8\overset{m}{.}6$ and A2 spectral type. HD 126511 and HD 126426 were used as comparison and check stars respectively. HD 126080 was classified as an RR Lyrae (Woitas) with a 0.69 day period. CCD observations show that this variable is not an RR Lyrae star but an eclipsing binary star with a period over 1 day (Figure 2). Photometric data indicate that the primary minimum has an amplitude of 0.48 magnitude, and the depth of the secondary minimum is $0\overset{m}{.}37$. The phase curve also displays an O'Connell effect (O'Connell 1951), amounting to $\Delta m = 0\overset{m}{.}1$ (Δm = Max.II−Max. I, where Max. I follows the primary minimum). The following ephemeris was computed:

$$\text{Min. I} = \text{HJD } 2450525.5234 + 1\overset{d}{.}056 \times E$$
$$\pm 0.0002 \pm 0.002$$

HD 341508 (= SAO 85688 = BD +23°3251 = PPM 106718 = AGK3 +23°1697 = GSC 2091.1465), is a star of 9.3 magnitude (photovisual) and G0 spectral type which, according to Woitas, is a classical Cepheid variable with a period of 5.89 days. This object was observed in the V band for 19 hours during six consecutive nights, from 13 to 18 March 1997, with a CCD camera, using the 0.41-m telescope at Mollet del Valles Observatory. BD +23°3249 was used as comparison star and GSC 2091.2251 as check star. Observations show that HD 341508 remained constant during the six nights within ±0.015 magnitudes. Correct identification with HD 341508 has been checked. If this star is variable, photometric results indicate that it is not a Cepheid.

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PHOTOMETRIC OBSERVATION OF T TAURI TYPE STARS: DI Cep, T Tau, V410 Tau, GW Ori, V649 Ori

Most of the pre-main sequence stars, as well as T Tauri type stars, are characterized by some kind of variability of their brightness. In the *UBV* photometric system, magnitudes of these stars change by up to 2.8 mag on a time scale of hours to years (e.g. Appenzeller and Mundt, 1989; Herbst et al., 1994).

Photometric observations over the past 50 years showed that sometimes regular, sometimes erratic behaviour casts some light on the processes taking place in these objects and on their interaction with the environment. On the analysis of more than 10000 entries on 80 young stars, Herbst et al. (1994) proposed that there were three groups of light variations related to the spectra of these stars. Application of modern Fourier analysis methods now allows to reveal periodic components of light variability for some of these objects. This property of the T Tauri stars can be explained by rotational modulation for a star with an asymmetric distribution of spots on its surface (e.g. Vrba et al., 1989; Shevchenko et al., 1991). However, a more detailed study of these objects needs a large quantity of observational data on individual stars during a long time interval.

Our *WBVR* observations of the T Tauri type stars DI Cep, T Tau, V410 Tau, GW Ori, and V649 Ori were carried out in autumn 1995 with the single-channel photon-counting photometer attached to the 60 cm telescope at the Crimean laboratory of Sternberg Astronomical Institute (Moscow). Observations were done by differential photometry. All stars were measured together with two comparison stars, and background light was measured at least twice in each band. For transformation to the standard system, we observed standard stars of luminosity classes IV–V and late spectral types from the list of Kornilov et al. (1991). Rms errors of the differential photometry are about 0.01–0.02 mag for *BVR* bands and 0.03 mag for the *W* band. In this note, we report on the results of observations for five objects. The results are presented in the table.

Application of the *W* photometric band (Straizys, 1977) for CTTSs has some advantages compared to the *U* band; thus, the *W* band has lower transmission at larger wavelengths decreasing the influence of the Balmer jump, which is essential for stars with emission-line spectra. On the other hand, the *W* band reduces the red leak, while the *U* band has a considerable red leak. Our measurements in the *W* band showed little difference compared to *U* band measurements of other authors (see, e.g., Herbst et al., 1994).

Table 1. $WBVR$ observations of T Tauri stars

JD24...	V	$W-B$	$B-V$	$V-R$	JD24...	V	$W-B$	$B-V$	$V-R$
T Tau					**GW Ori**				
50002.223	9.91	0.59	1.28	0.75	50002.320	9.67	0.38	1.03	0.90
50003.423	9.90	0.47	1.20	0.76	50003.377	9.69	0.38	1.02	0.88
50004.420	9.96	0.57	1.16	0.78	50004.390	9.73	0.37	1.03	0.89
50004.502	9.89	0.55	1.19	0.70	50004.552	9.81	0.34	0.96	0.92
50005.402	9.91	0.58	1.19	0.73	50006.467	9.80	0.46	0.88	0.95
50006.355	9.92	0.57	1.10	0.80	50006.550	9.97	0.38	0.86	
50006.379	9.94	0.50	1.18	0.80	50007.464	9.93	0.38	0.89	
50006.466	9.93	0.58	1.22	0.71	50008.462	9.88	0.37	0.88	
50007.353	9.96	0.56	1.26		50009.434	9.82	0.36	0.91	0.90
50007.420	9.97	0.55	1.23		50010.397	9.75	0.38	0.94	0.94
50008.387	9.86	0.54	1.16						
50009.361	9.90	0.52	1.17	0.79					
50010.363	9.91	0.53	1.19	0.73					
DI Cep									
49970.420	11.43	−0.15	0.87	0.57	50006.195	11.46	0.06	0.91	0.57
49973.401	11.40	−0.13	0.90	0.56	50006.233	11.46	0.06	0.94	0.68
49974.422	11.38	−0.17	0.91	0.58	50007.198	11.36	−0.26	0.89	
50002.402	11.68	−0.12	0.62	0.88	50008.197	11.40	−0.24	0.88	
50003.208	11.71	−0.25	0.65	0.89	50008.242	11.38	−0.25	0.90	
50004.202	11.41	−0.18	0.92	0.60	50009.218	11.36	−0.18	0.87	0.59
50004.289	11.43	−0.12	0.96	0.59	50009.270	11.36	−0.07	0.80	0.60
50005.206	11.42	−0.21	0.73	0.59	50010.309	11.36	−0.15	0.91	0.55
50005.261	11.43	0.04	0.75	0.55	50010.367	11.35	−0.14	0.91	0.55
50006.177	11.14	−0.32	0.21	0.26					
V410 Tau					**V649 Ori**				
49969.576	10.77	0.89	1.27	0.93	50002.379	12.02	0.51	1.11	0.72
49972.533	11.03	0.84	1.01	1.23	50003.472	12.00	0.49	1.10	0.74
49974.451	10.86	0.82	1.16	0.98	50004.420	11.99	0.53	0.98	0.77
50002.125	10.86	0.75	1.15	0.97	50007.473	11.98	0.57	1.01	
50003.323	10.98	0.91	1.02	1.20	50008.484	12.09	0.59	0.91	
50004.310	10.75	0.86	1.28	0.97	50009.442	12.11	0.51	0.99	0.82
50005.420	10.85	0.83	1.17	0.96	50010.413	12.12	0.46	1.06	0.85
50006.299	10.97	0.95	1.07	1.18					
50007.320	11.06	0.89	0.95						
50008.346	10.87	1.03	1.16						

Fortunately, a long sequence of clear nights on October 10–20 allowed me to get continuous measurements of some program stars. In the table, we presented Julian Dates, W, B, V, and R measurements.

Photometric monitoring of T Tauri type stars by different authors has revealed periodic variations in some stars, with periods between 2 and 15 days. Our data allow us to monitor variability of the program stars continuously, for 7–10 days. Moreover, our measurements show light variability of some stars within a night.

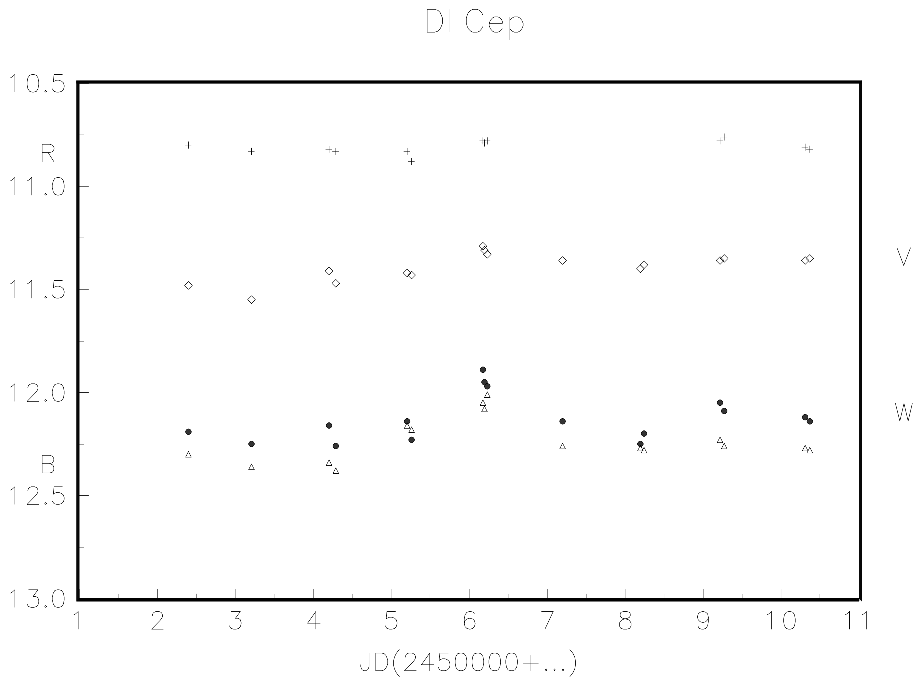

Figure 1

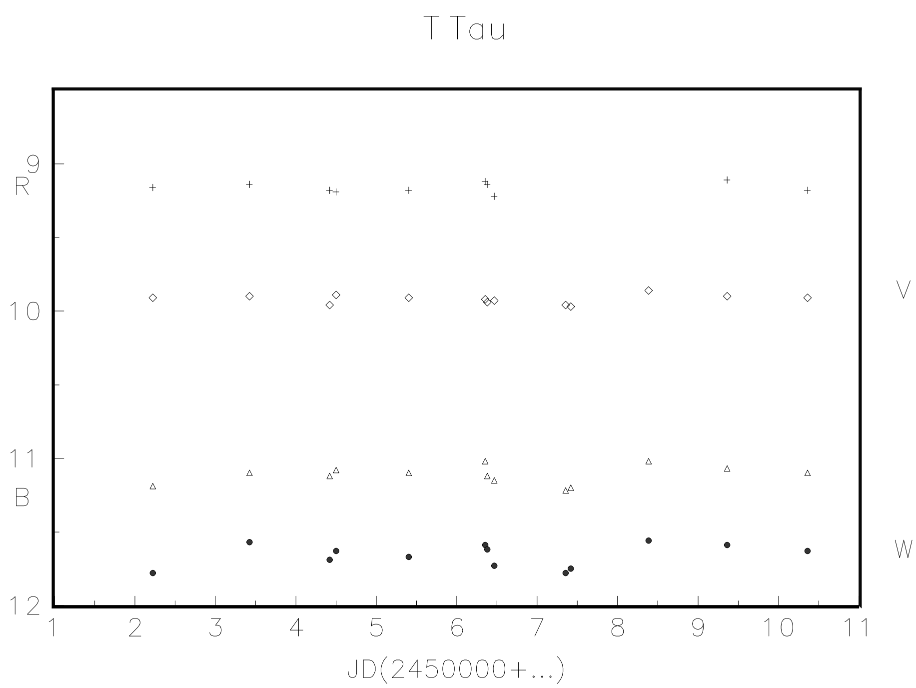

Figure 2

In Figures 1 and 2, as an example, we present portions of light curves respectively of DI Cep and T Tau in all photometric bands. Figure 1 shows that, on JD 2450006, DI Cep increased its brightness by $0\overset{m}{.}2$ in W and B and by $0\overset{m}{.}1$ in V and R bands. Thus, we see photometric activity of DI Cep during that night. Other program stars showed no marked photometric activity ($\Delta V \leq 0\overset{m}{.}1$).

So, continuous photometric monitoring has not revealed evident periodic modulation of brightness for program stars. We observed variability in $WBVR$ bands within $\Delta V = 0\overset{m}{.}1$ for all stars and a higher photometric activity for DI Cep.

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THE 73rd NAME-LIST OF VARIABLE STARS

The present 73rd Name-List of Variable Stars, compiled basically in the manner first introduced in the 67th Name-List (IBVS No. 2681, 1985), contains all data necessary for identification of 771 new variables finally designated in 1997. The total number of designated variable stars, not counting designated non-existing stars or stars subsequently identified with earlier-designated variables, has now reached 31918. In the nearest future, we are going to present two special Name-Lists containing variables discovered by the HIPPARCOS mission and in the frame of the OGLE project.

The 73rd Name-List consists of two tables. Table 1 contains the list of new variables arranged in the order of their right ascensions. It gives the ordinal number and the designation of each variable; its equatorial coordinates for the equinox 1950.0 (note that we have changed the standard accuracy. For all stars but two, we present right ascensions to $0^{s}.1$ and declinations to $1''$. The coordinates were found in the literature, taken from positional catalogues, including GSC, or determined by the authors. Sometimes the accuracy may actually be about 2 seconds of arc. For V725 and V726 Cas, we could not improve the published rough coordinates because finding charts are not available); the range of variability (sometimes the column "Min" gives, in parentheses, the amplitude of light variation); and the system of magnitudes used (the symbols "Rc", "Ic" designate magnitudes in Cousins's *RI* system; the symbols "y", "b", "u" mean Strömgren's y, b, u magnitudes; "g" designates magnitudes in the system of Thuan and Gunn; "T" stands for broad-band Tycho magnitudes formed from B and V measurements; "r" are red magnitudes not tied to a particular system); the type of variability according to the classification system described in the forewords to the first three volumes of the 4th GCVS edition (with the additions introduced in the 68th Name-List, IBVS No. 3058, 1987, in the 69th Name-List, IBVS No. 3323, 1989, and in the 72nd Name-List, IBVS No. 4140); two references to the list of papers which follows Table 2 (the first reference is to the investigation of the star, the second one indicates the paper containing a finding chart, or the corresponding Durchmusterung – BD, CoD, or CPD – containing the variable, or the Hubble Space Telescope Guide Star Catalog – GSC – if the star can be found using it).

In a small number of cases, the value of the variability amplitude (column "Min", in parentheses) could not be expressed in the same system of magnitudes as the star's brightness; in such cases we indicate the photometric band for the amplitude separately.

Table 2 contains the list of variables arranged in the order of their variable star names within constellations. After the designation of a variable, its ordinal number from Table 1 is given, as well as identifications with several major catalogues and identifications necessary to find this star in the papers with the first (or independent) announcement of the discovery of its variability. References to such papers are given in square brackets after the corresponding identification. The name of the discoverer accompanies the reference only in the case of its being different from the name of the author(s) of the paper referred to. For the stars having NSV catalogue numbers, the references to discovery papers already taken into account in the NSV catalogue are not always given. After the identifications, some minimal remarks are given if necessary.

Several **new corrections** to earlier Name-Lists have been found necessary. Thus, in the Name-List No. 67 (IBVS No. 2681), V2132 Oph is actually V1003 Oph, this was not revealed because of the then-adopted coordinates for V2132 Oph being seriously in error. The same applies to V489 Lyr (Name-List No. 71, IBVS No. 3840; actually the star is identical with BI Lyr).

Coordinates for several stars in the Name-Lists Nos. 67 (*op.cit.*), 68 (IBVS No. 3058), 72 (IBVS No. 4140) are, for different reasons, in error. The table below contains a list of these stars with corrected coordinates.

No.	Star		$\alpha_{1950.0}$	$\delta_{1950.0}$
67346	V930	Sco	$16^h\ 06^m 56^s$	$-23°43'.5$
67347	V931	Sco	16 08 44	−25 24.3
67350	V932	Sco	16 15 41	−28 37.9
67360	V938	Sco	16 27 01	−26 17.3
67361	V2131	Oph	16 28 14	−24 27.6
68242	AO	Lyn	06 13 11	+59 32.5
68567	V1902	Cyg	21 15 08	+37 33.4
72112	V702	Mon	07 44 04	−04 37.9
72338	V4314	Sgr	18 07 20	−31 23.3

The following significant identifications are to be added to the Name-Lists Nos. 67 and 72: PZ And = BD+49°620 (6.2), V1376 Aql = HD 335387 (K7), β Leo = Gliese 448, V1308 Ori = AFGL 5191, V4278 Sgr = NSV 10267, V4284 Sgr = NSV 10272, V4289 Sgr = NSV 10282.

Several more corrections to Name-List No. 72: V2012 Cyg should have the variability range 10.7 to 11.2 P, type SR:; V2303 Oph: the magnitudes quoted are in the V band; V353 Pup = NSV 03431, not 03731.

Note that the corrected version of the past Name-Lists, in the form of a combined Name-List Nos. 67–72, is available as a zip file from Sternberg Astronomical Institute (ftp neptun.sai.msu.su, cd pub/groups/cluster/gcvs).

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Table 1

No.	Name		R.A.,Decl.,1950.0		Max	Min		Type	Ref.
			h m s	o ' ''	m	m			
73001	AY	Scl	00 01 46.0	-30 56 17	8.98	9.88	J	EA	306 GSC
73002	V706	Cas	00 04 56.9	+64 26 38	12.0	16.0	V	M:	072 072
73003	V707	Cas	00 05 41.3	+52 29 16	11.6	16.8	V	M:	072 072
73004	V708	Cas	00 08 34.1	+64 02 49	11.5	16.5	V	M:	072 072
73005	LN	Peg	00 09 54.6	+14 17 11	8.40	8.59	V	RS	005 BD
73006	BI	Psc	00 10 07.6	+12 51 24	13.3	18.5	B	UV	270 270
73007	QR	And	00 17 14.0	+21 40 13	12.16	12.69	V	NL	001 002
73008	QS	And	00 19 03.7	+27 52 49	16.67	17.09	V	EW	003
73009	V709	Cas	00 26 01.9	+59 00 47	14.75	15.35	B	XM	068 068
73010	V710	Cas	00 33 52.1	+63 12 24	18.6	21.6	V	FU	074 074
73011	V711	Cas	00 35 37.8	+48 06 26	25.02	26.19	g	E	075 075
73012	V712	Cas	00 35 41.0	+48 03 40	24.48	25.41	g	E	075 075
73013	V713	Cas	00 35 41.6	+48 05 23	24.55	25.59	g	E	075 075
73014	V714	Cas	00 35 41.7	+48 09 51	24.46	25.32	g	E	075 075
73015	V715	Cas	00 36 08.0	+48 08 48	24.32	25.44	g	E	075 075
73016	V716	Cas	00 36 11.4	+48 10 39	24.17	(25.08	g	E:	075 075
73017	V717	Cas	00 36 11.4	+48 07 57	24.28	25.33	g	RRC:	075 075
73018	V718	Cas	00 36 11.8	+48 11 04	24.22	25.20	g	E	075 075
73019	V719	Cas	00 36 12.6	+48 10 30	24.30	25.33	g	E	075 075
73020	BK	Psc	00 37 04.6	+10 22 55	10.41	10.60	V	RS	269 153
73021	QT	And	00 38 35.5	+34 08 52	9.5	(0.43 Rc)	V	BY+UV	004 BD
73022	BL	Psc	00 41 25.4	+09 16 36	11.30	11.39	U	NL	271 153
73023	V720	Cas	00 42 16.3	+53 10 24	9.6	12.5	P	SR	076 077
73024	BG	Phe	00 46 48.4	-56 22 09	10.31	10.36	V	BE	266 267
73025	AZ	Scl	00 50 39.0	-36 36 38	12.32	12.54	V	BE	307 CoD
73026	V721	Cas	00 53 31.7	+59 23 29	12.2	(15.0	V	M:	072 072
73027	alpha	Scl	00 56 11.9	-29 37 38	4.31	(0.04 u)	V	SXARI	308 CoD
73028	V722	Cas	00 56 20.8	+60 28 11	11.9	14.7	V	M:	072 072
73029	sigma	Scl	01 00 03.3	-31 49 15	5.50	(0.03 u)	V	ACV:	308 CoD
73030	V723	Cas	01 02 06.6	+53 44 37	7.08	(18.	V	NB	078 079
73031	QU	And	01 10 12.6	+41 23 23	7.25	(0.05)	V	RS	005 BD
73032	V724	Cas	01 11 37.8	+63 20 53	10.8	16.2	V	M:	072 072
73033	BM	Psc	01 11 54.5	+27 50 53	16.22	16.72	V	EW	003
73034	QV	And	01 13 27.0	+47 49 07	6.22	(0.05)	U	ACV	006 BD
73035	QW	And	01 15 48.6	+49 23 51	12.6	(0.45)	V	EW	007 GSC
73036	BN	Psc	01 24 54.2	+27 52 15	16.45	16.75	V	EW	003
73037	BW	Cet	01 28 47.8	-11 22 33	9.38	(0.01 B)	V	ACVO	101 BD
73038	BB	Scl	01 32 42.0	-30 10 01	7.10	7.17	V	E	055 CoD
73039	BO	Psc	01 46 29.3	+06 09 10	12.78	12.83	V	BY	103 GSC
73040	QX	And	01 54 58.8	+37 33 48	11.25	11.57	V	EW	008 009
73041	XY	Tri	01 56 47.6	+27 47 15	16.29	17.56	V	RRAB	003
73042	XZ	Tri	01 59 41.8	+27 53 33	16.67	18.00	V	RRAB	003
73043	QY	And	02 07 54.0	+48 37 34	11.1	11.9	P	SRA	010 010
73044	ER	Eri	02 08 24.4	-54 44 48	9.6	11.59	U	UV:	155 CPD

Table 1 (continued)

No.	Name		R.A.,Decl.,1950.0		Max	Min		Type	Ref.
			h m s	o ' ''	m	m			
73045	V519	Per	02 15 01.0	+56 58 51	9.05	9.40	V	BE	257 BD
73046	YY	Tri	02 15 12.5	+28 22 59	5.84	7.72	K	M	014
73047	V520	Per	02 15 32.6	+56 54 20	6.55	6.66	V	IA	257 BD
73048	V725	Cas	02 17 54	+60 20	12.8	15.4	I	M	080
73049	XZ	Ari	02 29 28.8	+27 49 52	13.85	14.08	V	EW	003 GSC
73050	BX	Cet	02 33 30.5	+06 38 03	11.64	11.68	V	BY	018 102
73051	V726	Cas	02 33 38	+61 48	11.1	12.1	I	L	080
73052	YY	Ari	02 40 25.3	+21 50 53	5.12	5.32	J	SR	033 GSC
73053	BY	Cet	02 44 53.3	-00 24 54	9.55	9.69	V	RS	103 BD
73054	VW	For	02 50 44.7	-30 49 57	19.5	20.5	P	AM:	015 015
73055	YZ	Ari	02 54 44.3	+11 06 03	5.05	6.55	J	M	014
73056	BZ	Cet	02 57 21.6	+07 33 06	7.95	(0.05)	V	BY	005 BD
73057	V727	Cas	02 58 53.3	+69 56 17	10.0	15.8	P	M	081 081
73058	V521	Per	03 04 21.2	+47 07 01	6.41	6.42	V	DSCTC	258 BD
73059	CC	Cet	03 08 12.8	+09 38 10	13.80	14.07	H	R	104 GSC
73060	CD	Cet	03 10 39.4	+04 35 13	13.81	13.87	V	BY	018 102
73061	V522	Per	03 14 58.8	+47 10 21	11.50	(0.15)	V	BY	259 262
73062	V523	Per	03 15 20.1	+48 05 10	12.59	(0.04)	V	BY	260 GSC
73063	V524	Per	03 15 27.1	+48 39 50	13.44	(0.14)	V	BY	373 GSC
73064	V525	Per	03 15 32.5	+48 00 08	11.99	(0.10)	V	BY	260 262
73065	ES	Eri	03 15 48.4	-19 55 09	10.70	10.78	V	RS:	156 GSC
73066	V526	Per	03 16 23.8	+49 41 17	12.37	12.64	V	BY	261 261
73067	V527	Per	03 16 33.4	+46 42 12	12.57	(0.04)	V	BY	259 GSC
73068	V528	Per	03 17 44.6	+48 24 22	12.80	(0.18)	V	BY	262 262
73069	V529	Per	03 18 37.1	+47 23 25	12.00	(0.15)	V	BY	260 262
73070	V530	Per	03 21 15.3	+48 42 47	11.71	(0.09)	V	BY	259 262
73071	V531	Per	03 21 16.8	+48 41 46	11.63	(0.06)	V	BY	259 262
73072	V532	Per	03 22 47.8	+49 15 09	11.27	(0.11)	V	BY	262 262
73073	V533	Per	03 24 06.1	+48 14 36	15.74	(0.11)	V	BY	260 261
73074	V534	Per	03 24 16.8	+49 01 47	12.29	(0.03)	V	BY	259 GSC
73075	V535	Per	03 24 40.0	+47 15 05	13.52	(0.10)	V	BY	263 GSC
73076	VX	For	03 24 49.2	-34 37 00	12.2	(19.	V	UG:	161 064
73077	V536	Per	03 25 14.1	+49 01 34	13.05	(0.20)	V	BY	259 262
73078	CE	Cam	03 25 54.2	+58 42 26	4.54	(0.03)	V	ACYG	044 BD
73079	CL	Oct	03 26 16.4	-85 42 58	14.72	14.90	V	ZZ	208 208
73080	ET	Eri	03 28 44.9	-15 35 03	4.46	4.68	J	SRB	033 GSC
73081	V537	Per	03 28 55.6	+49 00 27	11.98	(0.19)	V	BY	262 262
73082	V538	Per	03 29 14.5	+49 40 38	13.08	(0.08)	V	BY	263 GSC
73083	VY	For	03 29 56.9	-26 07 03	17.45	19.2	V	XM	162 163
73084	V539	Per	03 30 53.5	+49 11 43	13.24	(0.07)	V	BY	263 GSC
73085	CF	Cam	03 31 11.9	+58 07 42	13.3	14.3	P	DCEP:	045 GSC
73086	V540	Per	03 32 46.2	+48 59 27	11.83	(0.11)	V	BY	262 262
73087	V541	Per	03 33 19.4	+48 14 06	12.45	(0.11)	V	BY	259 262
73088	V1082	Tau	03 36 41.2	+18 13 34	8.19	(0.05)	V	RS	005 BD

Table 1 (continued)

No.	Name		R.A.,Decl.,1950.0 h m s	° ' ''	Max m	Min m		Type	Ref.
73089	V542	Per	03 36 59.7	+47 54 57	12.89	(0.04)	V	BY	259 GSC
73090	V1083	Tau	03 41 03.6	+06 46 04	5.99	7.39	J	M	014
73091	V1084	Tau	03 41 21.3	+24 37 00	11.04	(0.08)	V	RS	263 315
73092	V543	Per	03 42 11.8	+46 08 44	12.21	(0.12)	V	BY	260 222
73093	EU	Eri	03 42 34.6	-42 03 14	8.22	8.99	T	SRC	157 CoD
73094	V1085	Tau	03 42 36.9	+23 55 42	10.12	(0.05)	V	BY	259 315
73095	V1086	Tau	03 44 04.3	+27 54 28	17.27	18.40	V	RRAB	003
73096	V1087	Tau	03 44 23.5	+24 41 44	16.8	(20.0	U	UV	316 317
73097	CG	Cam	03 44 49.4	+68 01 18	14.2	15.8	B	RCB:	046 GSC
73098	V1088	Tau	03 46 16.9	+24 24 05	16.0	17.2	P	UV	318 318
73099	V1089	Tau	03 46 25.6	+23 41 17	11.35	(0.06)	V	BY	263 315
73100	V1090	Tau	03 46 34.7	+23 38 40	10.93	(0.03)	V	BY	263 315
73101	V1091	Tau	03 47 35.3	+25 16 36	12.2	13.1	U	UV	319 319
73102	V1092	Tau	03 54 01.0	+28 29 16	11.7	(0.13)	V	BY+UV	321 153
73103	V1093	Tau	04 00 39.5	+27 55 20	17.40	18.13	V	EW	003
73104	CH	Cam	04 02 40.8	+60 47 12	14.4	(0.1)	V	ZZ	047 048
73105	EV	Eri	04 06 43.4	-09 22 03	5.12	6.38	J	SRB	033 GSC
73106	V544	Per	04 08 35.5	+51 02 07	13.5	14.1	V	LB	264 264
73107	V1094	Tau	04 09 05.7	+21 49 14	8.95	9.43	V	EA	322 BD
73108	V1095	Tau	04 10 08.4	+28 11 35	13.67	13.76	V	BY	323 324
73109	V1096	Tau	04 10 21.6	+28 08 50	13.37	13.58	V	BY	323 324
73110	V1097	Tau	04 11 23.8	+28 44 02	11.64	12.37	V	BY	323 324
73111	V1098	Tau	04 11 42.8	+27 45 05	12.00	12.19	V	INB	325 324
73112	TW	Ret	04 12 03.3	-65 16 14	7.11	7.69	J	RV:	033
73113	V1099	Tau	04 12 55.7	+15 16 38	5.58	(0.02)	V	ELL:	326 BD
73114	V545	Per	04 14 40.0	+42 01 12	6.22	(0.04)	V	LBV	265 BD
73115	CI	Cam	04 15 39.2	+55 52 45	12.31	13.08	B	ZAND:	049 GSC
73116	TX	Ret	04 16 10.9	-64 26 16	8.6	(0.03)	B	DSCTC	067 CPD
73117	V1100	Tau	04 18 29.4	+20 08 55	12.5	(15.5	P	M	256 256
73118	V1101	Tau	04 21 53.8	+21 55 51	14.8	16.2	P	UV	327 328
73119	TY	Ret	04 23 52.4	-67 13 49	6.90	7.06	J	SR	033 GSC
73120	V1102	Tau	04 25 35.4	+17 35 10	12.05	(0.07)	V	BY	263 329
73121	V1103	Tau	04 26 06.5	+18 33 52	13.10	13.31	V	BY	323 324
73122	V1104	Tau	04 26 08.3	+16 14 14	14.26	(0.05)	V	BY	263 329
73123	V546	Per	04 26 59.1	+39 44 58	13.90	13.96	V	BY	018 102
73124	V1105	Tau	04 27 52.3	+24 43 57	13.7	18.0	P	UV	330 328
73125	V1106	Tau	04 30 12.7	+24 15 20	16.0	17.2	P	UV	327 328
73126	V1107	Tau	04 30 28.6	+22 35 44	15.7	19.8	P	UV	327 328
73127	V1108	Tau	04 31 14.4	+22 20 33	14.7	16.1	P	UV	327 328
73128	V1109	Tau	04 31 20.1	+22 17 44	14.8	15.9	P	UV	327 328
73129	V1110	Tau	04 31 36.8	+24 54 51	10.34	(0.06)	V	RS	005 BD
73130	V1111	Tau	04 31 39.0	+24 40 55	15.0	18.8	P	UV	330 328
73131	V1112	Tau	04 31 42.0	+08 15 51	13.1	(0.62)	V	EW	331 331
73132	V1113	Tau	04 31 52.6	+22 12 10	14.5	16.7	P	UV	330 328

Table 1 (continued)

No.	Name		R.A.,Decl.,1950.0		Max	Min		Type	Ref.
			h m s	o ' ''	m	m			
73133	EW	Eri	04 32 44.3	-14 19 49	9.30	9.71	J	INT	158 159
73134	V1114	Tau	04 33 08.0	+23 22 27	14.1	16.0	P	UV	330 328
73135	V1115	Tau	04 33 15.4	+25 36 56	11.65	11.82	V	BY	325 324
73136	V1116	Tau	04 33 28.2	+23 14 26	6.02	(0.01)	V	DSCTC:	326 BD
73137	V1117	Tau	04 35 15.4	+22 56 32	14.1	15.3	P	UV	330 328
73138	TZ	Ret	04 36 12.8	-59 09 49	18.31	20.01	B	RRAB	278 278
73139	V1118	Tau	04 37 41.5	+22 55 30	15.1	16.4	P	UV	327 328
73140	EX	Eri	04 44 25.9	-28 10 36	6.19	(0.03 b)	V	DSCTC	160 CoD
73141	EY	Eri	04 50 35.3	-10 06 54	6.35	9.03	J	M	014
73142	RS	Cae	04 51 49.9	-42 18 31	18.4	19.6	V	XM	043 043
73143	V402	Aur	04 59 01.8	+31 11 33	8.84	8.98	V	EW	034 BD
73144	CK	Cam	05 02 24.2	+55 17 12	7.19	7.80	V	DCEP	050 BD
73145	EZ	Eri	05 05 00.9	-05 28 17	10.17	10.29	V	RS	156 BD
73146	UU	Col	05 10 21.4	-32 45 10	17.25	18.2	B	XM	113 113
73147	CL	Cam	05 11 36.0	+75 53 34	7.55	(0.13)	V	RS	005 BD
73148	V1309	Ori	05 13 06.5	+01 01 22	15.2	17.3	V	XM+E	226 227
73149	UU	Pic	05 13 18.6	-52 57 11	19.5	20.5	P	NL	015 015
73150	UV	Col	05 15 01.5	-40 56 12	4.07	5.59	J	M	014 GSC
73151	UV	Pic	05 19 22.9	-45 44 25	11.80	11.93	V	BY	103 CoD
73152	V1119	Tau	05 21 30.3	+17 20 20	4.98	5.02	V	BY	242 BD
73153	UW	Col	05 24 15.2	-28 52 52	4.87	6.30	J	M	014
73154	V1310	Ori	05 25 30.5	-06 55 22	14.5	17.8	U	UVN	228 228
73155	UX	Col	05 27 06.5	-33 30 33	10.53	10.61	V	RS:	103 CoD
73156	V1311	Ori	05 29 34.3	-03 07 34	14.97	15.29	u	BY+UV	229 230
73157	UW	Pic	05 30 11.3	-46 26 15	16.4	17.6	V	XM	268 268
73158	V1312	Ori	05 30 18.9	-04 32 01	14.8	17.0	U	UVN	231 232
73159	V1313	Ori	05 32 16.0	-05 32 03	13.9	(0.15)	Ic	BY	233 234
73160	V1314	Ori	05 32 21.6	-05 33 41	13.9	(0.56)	Ic	FU:	233 234
73161	V1315	Ori	05 32 29.3	-05 23 31	14.6	(0.14)	Ic	BY	233 234
73162	V1316	Ori	05 32 30.1	-05 32 37	14.1	(0.10)	Ic	BY	233 234
73163	V1317	Ori	05 32 30.5	-05 30 37	16.1	(2.04)	Ic	INS	233 234
73164	V1318	Ori	05 32 32.1	-05 25 55	14.2	(0.14)	Ic	BY	233 234
73165	V1319	Ori	05 32 34.6	-05 28 31	12.9	(0.11)	Ic	BY	233 234
73166	V1320	Ori	05 32 34.8	-05 31 04	13.9	(0.21)	Ic	BY	233 234
73167	V1321	Ori	05 32 36.5	-05 10 07	10.55	10.75	V	INT	103 232
73168	V1322	Ori	05 32 36.8	-05 28 22	13.9	(0.11)	Ic	BY	233 234
73169	V1323	Ori	05 32 37.2	-05 28 17	14.2	(0.19)	Ic	BY	233 234
73170	V1324	Ori	05 32 38.2	-05 27 00	13.0	(0.11)	Ic	BY	233 234
73171	V1325	Ori	05 32 41.3	-05 30 55	15.0	(0.15)	Ic	BY	233 234
73172	V1326	Ori	05 32 42.3	-05 25 21	11.9	(0.3)	Ic	BY	233 234
73173	V1327	Ori	05 32 45.8	-05 19 04	13.9	(0.10)	Ic	BY	233 234
73174	V1328	Ori	05 32 46.8	-05 26 18	11.8	(0.13)	Ic	BY	233 234
73175	V1329	Ori	05 32 46.8	-05 19 19	14.7	(0.15)	Ic	BY	233 234
73176	V1330	Ori	05 32 47.4	-05 24 33	11.86	(0.31)	Ic	BY	233 234

Table 1 (continued)

No.	Name		R.A.,Decl.,1950.0 h m s	o ' ''	Max m	Min m		Type	Ref.
73177	V1331	Ori	05 32 47.8	-05 24 09	12.5	(2.11)	Ic	BY:	233 234
73178	V1332	Ori	05 32 48.2	-05 23 33	13.8	(0.47)	Ic	BY	233 234
73179	V1333	Ori	05 32 49.5	-05 24 26	12.2	(0.21)	Ic	BY	233 234
73180	V1334	Ori	05 32 50.3	-05 17 26	14.3	(0.77)	Ic	IN	233 234
73181	V1335	Ori	05 32 50.3	-05 17 32	14.6	(0.38)	Ic	BY	233 234
73182	V1336	Ori	05 32 50.8	-05 25 58	17.95	19.46	V	UVN	235 234
73183	V1337	Ori	05 32 51.6	-05 25 43	13.1	(2.32)	Ic	FU:	233 234
73184	V1338	Ori	05 32 52.7	-05 28 32	11.7	(0.08)	Ic	BY	233 234
73185	V1339	Ori	05 32 53.7	-05 27 50	13.3	(1.56)	Ic	FU:	233 234
73186	V1340	Ori	05 32 54.9	-05 29 21	14.4	(0.42)	Ic	BY	233 234
73187	V1341	Ori	05 32 55.0	-05 17 02	15.9	(0.62)	Ic	BY	233 234
73188	V1342	Ori	05 32 56.1	-05 27 19	13.9	(4.47)	Ic	INS	233 234
73189	V1343	Ori	05 32 57.4	-05 12 17		(1.30)	Ic	IN	233
73190	V1344	Ori	05 32 57.5	-05 11 20	13.5	(0.10)	Ic	BY	233 234
73191	V1345	Ori	05 32 59.8	-05 19 03	13.6	(0.15)	Ic	BY	233 234
73192	V1346	Ori	05 33 00.2	-05 09 44		(1.99)	Ic	FU:	233
73193	V1347	Ori	05 33 00.3	-05 18 50	13.3	(0.07)	Ic	BY	233 234
73194	V1348	Ori	05 33 02.9	-05 27 31	13.1	(0.76)	Ic	BY	233 234
73195	V1349	Ori	05 33 04.2	-05 09 58		(1.07)	Ic	INS	233
73196	V1350	Ori	05 33 10.1	-05 29 08	13.9	(0.10)	Ic	BY	233 234
73197	V1351	Ori	05 33 18.2	-05 30 14	13.8	(0.14)	Ic	BY	233 234
73198	UX	Pic	05 34 30.1	-44 06 27	3.90	5.47	J	M	014 GSC
73199	UY	Pic	05 35 36.7	-47 59 36	7.86	7.97	V	RS:	269 153
73200	V1352	Ori	05 39 13.9	+12 29 16	11.48	11.55	V	BY	018 237
73201	V1353	Ori	05 40 24.9	-00 44 06	12.9	(0.31 Rc)	V	EW	238 238
73202	V1354	Ori	05 41 21.1	-04 36 09	14.87	15.79	u	INT	229 239
73203	khi1	Ori	05 51 25.2	+20 16 08	4.38	4.41	V	RS	242 BD
73204	V403	Aur	05 53 14.0	+49 01 26	6.47	(0.19)	V	RS	005 BD
73205	V404	Aur	05 53 36.4	+43 27 57	12.2	(0.59)	V	EB	035 036
73206	V405	Aur	05 53 54.0	+53 53 27	14.6	(0.12)	V	XM	037 352
73207	UY	Col	05 57 47.3	-30 39 59	8.95	9.12	V	DSCT	114 CoD
73208	V1355	Ori	06 00 07.6	-00 51 31	8.97	9.35	V	RS	055 BD
73209	V1356	Ori	06 05 33.8	+13 57 19	10.80	(0.15 u)	V	ACV	240 241
73210	HY	CMa	06 10 25.2	-16 47 48	9.26	9.84	V	E/RS	055 BD
73211	V1357	Ori	06 10 26.0	+10 38 44	6.44	6.49	V	RS:	242 BD
73212	V406	Aur	06 14 35.4	+32 31 27	7.45	7.58	V	EA	038 BD
73213	V1358	Ori	06 16 38.3	-03 25 00	7.91	7.99	V	BY	055 BD
73214	AH	Men	06 16 54.2	-81 48 22	13.15	13.90	V	NL	195 111
73215	V435	Car	06 20 39.1	-51 12 43	7.3	(0.02)	B	DSCTC	067 CoD
73216	V713	Mon	06 23 04.6	-09 30 20	7.75	10.01	J	M	198 199
73217	V714	Mon	06 26 33.2	+04 46 42	11.5	(0.64)	V	EW	200 200
73218	V715	Mon	06 46 28.8	+01 03 35	5.34	(0.18 u)	U	LBV:	201 BD
73219	PR	Gem	06 47 24.7	+28 07 38	18.04	18.83	V	EW	003
73220	HZ	CMa	06 48 29.9	-31 38 48	5.69	5.82	y	ELL	056 CoD

Table 1 (continued)

No.	Name		R.A.,Decl.,1950.0 h m s	° ' ''	Max m	Min m		Type	Ref.
73221	II	CMa	06 55 17.8	-13 10 32	15.22	15.74	V	EW	057 057
73222	IK	CMa	06 55 23.6	-13 09 09	18.00	18.43	V	EW	057 057
73223	CM	Cam	06 57 33.2	+75 29 04	6.96	(0.05)	V	FKCOM	005 BD
73224	PS	Gem	07 00 53.6	+10 50 42	7.24	7.58	V	SRD	164 BD
73225	IL	CMa	07 04 04.8	-30 34 40	6.32	6.54	V	E+LBV:	058 CoD
73226	IM	CMa	07 16 48.8	-24 51 50	10.52	10.58	b	ELL:	059 060
73227	IN	CMa	07 18 52.3	-31 41 16	14.64	14.89	V	NL	061
73228	BL	Lyn	07 28 39.4	+36 20 25	11.76	11.80	V	BY	018 102
73229	BM	Lyn	07 43 42.0	+47 27 43	7.70	(0.25)	V	RS+E	005 BD
73230	V436	Car	07 43 43.5	-52 49 53	13.6	15.8	B	UG:	068 068
73231	V354	Pup	07 45 23.7	-27 12 37	17.71	(0.04 y)	B	ZZ	274 048
73232	BM	CMi	07 46 13.0	+05 47 00	14.34	15.23	V	IS	062 062
73233	V716	Mon	07 50 20.9	-10 34 57	13.8	(0.44)	B	RRAB	110 202
73234	PT	Gem	07 51 31.5	+28 07 53	15.77	16.30	V	RRAB	003
73235	V355	Pup	08 04 18.3	-20 11 22	8.5	(0.04)	B	DSCTC	067 BD
73236	EW	UMa	08 12 49.6	+73 14 35	9.83	11.08	V	IS	062 062
73237	BN	Lyn	08 19 25.2	+43 21 01	4.21	4.27	V	SRD:	039 BD
73238	FI	Cnc	08 29 13.9	+29 29 23	7.28	(0.17)	V	FKCOM	005 BD
73239	FK	Cnc	08 30 20.9	+11 26 23	7.94	(0.03)	V	BY:	005 BD
73240	WX	Pyx	08 30 54.1	-22 38 15	16.2	17.74	V	XM	275 111
73241	WY	Pyx	08 34 53.5	-36 17 07	9.0	(12.	V	M	030 030
73242	MN	Vel	08 36 22.2	-46 43 41	7.89	9.35	T	SRA	157 CoD
73243	BO	Lyn	08 39 43.1	+41 10 40	12.2	(0.32)	B	DSCT	188 GSC
73244	FL	Cnc	08 41 09.5	+32 14 38	7.03	(0.06)	V	DSCTC	053 BD
73245	EX	UMa	08 41 21.5	+56 47 22	10.90	11.38	V	RRAB	334 334
73246	FM	Cnc	08 44 36.4	+28 11 03	15.51	16.71	V	RRAB	003
73247	MO	Vel	08 46 39.6	-41 50 10	9.58	(0.01 B)	V	ACVO	339 CoD
73248	WZ	Pyx	08 51 42.0	-24 36 08	9.35	11.64	Rc	M	276 276
73249	XX	Pyx	08 56 27.1	-24 23 30	11.49	(0.08 B)	V	DSCTC	277 CoD
73250	EY	UMa	08 58 51.2	+50 01 07	13.2	14.4	P	RRAB	335 336
73251	FN	Cnc	08 59 03.5	+28 10 23	15.40	16.71	V	RRAB	003
73252	BP	Lyn	08 59 53.9	+41 29 40	14.19	14.33	B	E+NL	189 111
73253	MP	Vel	09 09 16.1	-43 03 52	7.8	(0.02)	V	DSCTC	067 CoD
73254	MM	Hya	09 11 45.5	-06 35 17	14.1	18.7	B	UG	169 111
73255	MQ	Vel	09 19 28.3	-45 18 06	3.5	5.2	K	M	029
73256	EZ	UMa	09 21 44.0	+64 09 27	6.23	6.28	V	SRD:	005 BD
73257	MR	Vel	09 23 58.8	-47 45 15	16.98	17.30	V	XI	340 340
73258	MN	Hya	09 26 51.5	-23 51 56	16.4	18.5	Ic	XM+EA	178 178
73259	DX	Leo	09 29 49.9	+27 12 50	7.00	(0.10)	V	BY	360 BD
73260	FF	UMa	09 29 54.2	+63 03 01	8.35	(0.12)	V	RS	005 BD
73261	AK	Ant	09 32 44.7	-28 39 15	8.3	(0.03 b)	V	DSCTC	012 BD
73262	MS	Vel	09 34 32.2	-52 19 11	8.13	8.98	T	SRA	157 CoD
73263	MT	Vel	09 43 43.5	-45 40 49	8.1	(0.09)	B	DSCTC	067 CoD
73264	MU	Vel	09 45 02.0	-47 16 44	8.6	10.4	K	M	029

Table 1 (continued)

No.	Name		R.A.,Decl.,1950.0		Max	Min		Type	Ref.
			h m s	o ' ''	m	m			
73265	DY	Leo	09 47 08.7	+11 20 28	7.59	(0.05)	V	RS	005 BD
73266	V437	Car	09 53 16.9	-58 27 31	9.32	(0.01 B)	V	ACVO	069 CPD
73267	DZ	Leo	09 54 50.0	+28 12 47	16.27	16.84	V	RRC	003
73268	TU	Sex	10 10 46.9	-01 28 56	16.4	17.0	B	EW	314 314
73269	FG	UMa	10 18 23.3	+61 09 55	7.45	(0.11)	V	RS	005 BD
73270	MV	Vel	10 19 03.0	-55 47 27	4.49	(0.06)	V	BE	309 CPD
73271	SY	LMi	10 23 58.6	+28 14 19	17.71	18.68	V	RRAB	003
73272	V438	Car	10 33 50.0	-57 58 57	11.25	(0.07 B)	V	ELL:	070 070
73273	V439	Car	10 33 58.5	-57 58 24	13.46	(0.05 B)	V	BE:	070 070
73274	V440	Car	10 34 00.1	-57 57 25	9.14	(0.01)	B	BCEP	070 070
73275	SZ	LMi	10 34 12.3	+28 10 48	17.46	18.42	V	RRAB	003
73276	V441	Car	10 34 18.0	-57 58 36	13.51	(0.04 B)	V	ELL:	070 070
73277	FH	UMa	10 43 53.0	+63 51 02	19.4	(1.8)	V	AM	337 337
73278	EE	Leo	10 48 18.6	+07 05 05	11.64	11.70	V	BY	018 066
73279	TT	LMi	10 55 39.0	+28 14 49	16.42	17.00	V	RRC	003
73280	V442	Car	10 57 09.4	-60 02 36	13.82	14.45	V	DCEP	071 071
73281	V443	Car	10 57 39.5	-60 05 17	13.12	(0.04)	V	DSCTC	071 071
73282	MW	Vel	11 02 17.9	-50 57 07	8.43	10.00	T	SRB:	157 CoD
73283	FI	UMa	11 09 50.6	+55 26 16	6.65	(0.03 b)	V	DSCTC	338 BD
73284	FK	UMa	11 14 34.4	+29 50 37	9.29	(0.04)	V	RS	005 BD
73285	TV	Crt	11 19 37.1	-24 30 11	8.91	8.98	V	RS	005 CoD
73286	CN	Cam	11 32 51.6	+81 34 18	9.80	10.27	B	RRAB	051 BD
73287	V885	Cen	11 38 33.7	-55 17 48	7.60	7.95	U	*	084 CPD
73288	EF	Leo	11 46 35.4	+28 17 06	14.52	15.78	V	RRAB	003
73289	IQ	Vir	11 51 16.6	+00 49 49	6.30	(0.02)	V	DSCTC	067 BD
73290	TW	Crv	11 57 32.1	-18 45 22	12.68	13.55	V	R	128 GSC
73291	IQ	Com	12 03 30.7	+28 16 00	14.92	16.17	V	RRAB	003
73292	CO	Cru	12 06 17.5	-55 27 00	9.22	9.30	V	DSCTC	129 CPD
73293	CP	Cru	12 07 52.7	-61 28 28	9.2	(12.	V	NA:	130
73294	CO	Cam	12 09 52.8	+77 53 38	5.14	(0.07)	V	ELL	052 BD
73295	GV	Mus	12 34 08.9	-68 02 10	16.82	17.05	Ic	EW	203 203
73296	GW	Mus	12 34 12.3	-68 00 50	17.74	18.02	Ic	EW	203 203
73297	GX	Mus	12 34 12.3	-68 11 08	15.76	16.07	Ic	EW	203 203
73298	GY	Mus	12 34 13.8	-68 11 50	15.61	15.69	Ic	EW	203 203
73299	GZ	Mus	12 34 31.4	-68 04 58	16.01	16.39	Ic	EW	203 203
73300	HH	Mus	12 34 33.3	-68 06 25	17.13	17.40	Ic	EA	203 203
73301	HI	Mus	12 34 37.2	-68 10 18	15.55	15.77	Ic	EB	203 203
73302	HK	Mus	12 34 44.8	-68 09 13	17.7	18.15:	Ic	EW	203 203
73303	HL	Mus	12 34 45.1	-68 05 47	14.74	15.07	Ic	EW	203 203
73304	HM	Mus	12 34 47.2	-68 06 34	16.32	16.95	Ic	EW	203 203
73305	HN	Mus	12 34 51.5	-68 06 04	15.03	16.03	Ic	EA	203 203
73306	HO	Mus	12 34 53.7	-68 06 52	14.99	15.11	Ic	EW	203 203
73307	HP	Mus	12 34 54.0	-68 05 56	17.8	18.1	Ic	EB	203 203
73308	HQ	Mus	12 34 55.1	-68 07 13	14.22	14.54	Ic	EB	203 203

Table 1 (continued)

No.	Name		R.A.,Decl.,1950.0 h m s	o ' ''	Max m	Min m		Type	Ref.	
73309	HR	Mus	12 34 55.4	-68 05 04	14.40	14.78	Ic	EA	203	203
73310	HS	Mus	12 34 55.9	-68 10 19	17.65	17.87	Ic	EB	203	203
73311	HT	Mus	12 34 57.2	-68 08 33	17.42	18.37	Ic	EA	203	203
73312	HU	Mus	12 34 57.4	-68 03 33	14.73	14.87	Ic	EW	203	203
73313	HV	Mus	12 34 57.7	-68 04 45	15.58	15.70	Ic	EW	203	203
73314	HW	Mus	12 35 00.0	-68 06 05	16.43	16.58:	Ic	EA:	203	203
73315	HX	Mus	12 35 04.0	-68 02 15	18.25	18.97	Ic	EW	203	203
73316	HY	Mus	12 35 04.9	-68 09 16	17.52	17.77	Ic	EW	203	203
73317	HZ	Mus	12 35 06.2	-68 01 10	15.12	15.27	Ic	EW	203	203
73318	II	Mus	12 35 09.7	-68 05 01	16.12	16.34	Ic	EW	203	203
73319	IK	Mus	12 35 11.4	-68 07 41	16.16	16.81	Ic	EW	203	203
73320	IL	Mus	12 35 11.8	-68 03 04	16.99	17.78	Ic	EW	203	203
73321	IM	Mus	12 35 12.1	-68 00 43	16.93	17.57	Ic	EA/D	203	203
73322	IN	Mus	12 35 14.2	-68 10 14	18.66	19.40	Ic	EA	203	203
73323	IO	Mus	12 35 16.1	-68 05 44	15.45	15.76	Ic	EW	203	203
73324	IP	Mus	12 35 16.2	-68 08 50	13.66	14.00	Ic	EA:	203	203
73325	IQ	Mus	12 35 16.4	-68 08 07	15.0	17.3	Ic	EA	203	203
73326	IR	Mus	12 35 18.0	-68 07 12	16.77	17.32	Ic	EW	203	203
73327	IS	Mus	12 35 20.1	-68 06 36	17.46	18.8	Ic	EW	203	203
73328	IT	Mus	12 35 28.7	-68 02 51	17.78	18.08	Ic	EW	203	203
73329	IU	Mus	12 35 30.5	-68 07 15	17.5	18.1	Ic	EW	203	203
73330	IR	Vir	12 35 34.0	-03 42 49	12.1	(0.70)	V	EW	341	341
73331	IV	Mus	12 35 39.4	-68 10 08	17.58	18.0	Ic	EB	203	203
73332	IW	Mus	12 35 41.9	-68 05 35	15.73	15.86	Ic	EW	203	203
73333	IX	Mus	12 35 43.4	-68 11 44	16.88	17.13	Ic	EW	203	203
73334	IY	Mus	12 35 43.5	-68 07 44	15.03	15.16	Ic	EB	203	203
73335	IZ	Mus	12 35 49.3	-68 10 47	16.93	17.60	Ic	EW	203	203
73336	KK	Mus	12 35 50.1	-68 00 11	15.27	15.78	Ic	EA	203	203
73337	KL	Mus	12 36 02.8	-67 59 56	15.56	15.61	Ic	EW	203	203
73338	V886	Cen	12 36 05.6	-49 31 27	13.96	(0.02)	V	ZZA	085	086
73339	KM	Mus	12 36 06.2	-68 10 57	16.20	16.50	Ic	EB	203	203
73340	V887	Cen	12 36 10.2	-50 48 55	19.11	19.87	B	RRAB	087	
73341	IR	Com	12 37 02.7	+21 24 34	13.4	18.5	P	UG:+E	355	
73342	MO	Hya	12 49 17.2	-26 28 02	6.15	(0.06 v)	V	DSCTC	179	CoD
73343	CQ	Cru	12 50 18.6	-60 05 51	12.52	(0.07 B)	V	E:	131	132
73344	CR	Cru	12 50 38.2	-60 05 28	11.44	(0.06 B)	V	E:	131	132
73345	CS	Cru	12 50 38.9	-60 07 27	9.83	(0.09 B)	V	E:	131	132
73346	CT	Cru	12 50 43.9	-60 06 13	9.82	(0.02 B)	V	BCEP	131	132
73347	CU	Cru	12 50 45.1	-60 05 51	13.15	(0.05 B)	V	E:	131	132
73348	CV	Cru	12 50 47.0	-60 02 19	9.99	(0.04 B)	V	BCEP+E:	131	132
73349	CW	Cru	12 50 51.4	-60 07 00	10.09	(0.20 B)	V	BE	131	132
73350	CX	Cru	12 50 51.8	-60 05 43	10.08	(0.04 B)	V	BCEP+E	131	132
73351	CY	Cru	12 50 52.1	-60 06 11	9.66	(0.05 B)	V	BCEP+E:	131	132
73352	CZ	Cru	12 50 52.9	-60 05 14	10.26	(0.02 B)	V	BCEP	131	132

Table 1 (continued)

No.	Name		R.A.,Decl.,1950.0 h m s	° ' ''	Max m	Min m		Type	Ref.
73353	BQ	CVn	12 56 48.5	+47 25 15	7.98	(0.09)	V	RS	005 BD
73354	V888	Cen	12 59 27.7	-59 55 31	7.59	(15.0	V	NA	088
73355	DL	Cha	13 02 14.8	-76 50 24	12.3	13.3	P	SRB	105 106
73356	IS	Vir	13 03 50.7	-04 34 43	8.27	(0.05)	V	RS	005 BD
73357	IS	Com	13 12 16.4	+28 12 20	13.62	13.95	V	RRC	003 GSC
73358	BR	CVn	13 20 57.0	+47 15 44	6.58	(0.50)	V	SRB	054 BD
73359	V889	Cen	13 23 40.6	-61 46 16	11.65	11.81	V	ELL	089 090
73360	KN	Mus	13 30 01.1	-65 43 04	14.92	(0.04)	B	ZZO	047 204
73361	IT	Com	13 32 45.0	+21 02 16	7.57	(0.20)	V	RS	005 BD
73362	V890	Cen	13 46 24.7	-47 39 47	19.0	21.5	P	NL	015 015
73363	V891	Cen	13 47 21.4	-47 47 57	19.0	21.0	P	NL	015 015
73364	V892	Cen	13 52 34.0	-51 28 19	9.47	9.95	V	EA+ACV:	091 CoD
73365	IT	Vir	13 53 02.9	-18 00 17	7.82	7.86	V	ELL	342 BD
73366	V893	Cen	13 56 52.0	-62 32 38	5.57	6.35	K	ZAND:	092 092
73367	BX	Cir	13 57 47.9	-65 55 27	12.53	12.58	V	PVTEL	107 090
73368	IU	Vir	14 01 14.4	-14 46 47	15.67	(0.40)	V	ZZA	343
73369	V894	Cen	14 12 14.7	-59 47 31	13.5	(19.0	Ic	SR	093 093
73370	IV	Vir	14 13 45.8	-21 31 56	10.71	10.86	V	ELL	344 BD
73371	CY	Boo	14 15 05.0	+15 29 38	5.74	5.90	V	SRB	039 BD
73372	V895	Cen	14 26 22.2	-37 50 49	16.5	18.1	V	E+AM:	354 094
73373	MP	Hya	14 28 07.9	-25 05 38	7.9	(0.02)	B	DSCTC	180 CoD
73374	CZ	Boo	14 31 34.4	+28 11 08	17.60	18.32	V	RRAB	003
73375	HN	Lib	14 31 35.2	-12 18 34	10.30	10.33	V	BY	018 BD
73376	V896	Cen	14 33 58.5	-59 32 53	8.4	(0.02)	V	DSCTC	067 CPD
73377	BY	Cir	14 40 51.2	-63 41 16	7.2	(12.	V	N	108 109
73378	DD	Boo	14 49 06.2	+23 44 48	12.8	(0.38)	V	RRC	040 040
73379	BZ	Cir	14 49 48.0	-68 04 06	18.15	(0.6)	V	NL	110 111
73380	DE	Boo	14 51 07.5	+19 21 11	6.00	(0.05)	V	RS	005 BD
73381	DF	Boo	14 53 02.2	+28 14 38	14.49	15.04	V	RRAB	003 GSC
73382	EU	Dra	15 09 57.1	+64 03 43	8.56	(0.20)	V	SRD:	147 BD
73383	NY	Ser	15 10 50.1	+23 26 18	14.8	17.9	V	UGSU	310 111
73384	CC	Cir	15 10 58.6	-59 39 23	11.71	(0.10)	V	WR	112 090
73385	UZ	CrB	15 14 53.0	+28 08 55	17.47	18.22	V	RRAB	003
73386	DG	Boo	15 16 24.6	+46 53 12	11.71	13.08	B	RRAB	041 042
73387	HO	Lib	15 16 50.4	-07 32 25	10.56	10.58	V	BY	018 BD
73388	HP	Lib	15 33 05.9	-14 03 17	13.65	13.80	V	ZZB:	183 GSC
73389	V354	Nor	15 35 24.2	-48 26 13	11.36	11.49	V	PVTEL	205 CoD
73390	HQ	Lib	15 36 03.8	-17 34 51	10.6	11.	V	ELL:	184 BD
73391	VV	CrB	15 48 59.6	+31 39 03	10.9	12.6	P	SRB	123 GSC
73392	lambd	Lib	15 50 25.6	-20 01 09	5.03	(0.02)	V	ELL	186 BD
73393	V1026	Sco	15 53 43.3	-21 53 00	8.85	9.83	T	IA	157 BD
73394	HR	Lib	15 53 44.3	-14 41 04	6.13	(0.02 b)	V	DSCTC	185 BD
73395	IN	Lup	15 55 51.3	-38 36 23	7.15	7.20	V	DSCTC	185 CoD
73396	IO	Lup	15 57 26.4	-38 56 52	6.65	(0.03 b)	V	DSCTC	187 CoD

Table 1 (continued)

No.	Name		R.A.,Decl.,1950.0		Max	Min		Type	Ref.	
			h m s	o ' ''	m	m				
73397	VW	CrB	15 58 07.9	+33 19 39	14.5	(17.5	B	UG	124	124
73398	VX	CrB	15 58 10.3	+35 06 45	13.6	15.0	B	RRAB	124	124
73399	EV	Dra	16 00 26.9	+51 29 08	8.63	(0.06)	V	RS	005	BD
73400	VY	CrB	16 04 16.6	+33 30 17	13.7	15.1	B	RRAB	124	124
73401	V842	Her	16 04 39.1	+50 19 13	9.85	10.45	V	EW	167	BD
73402	V1027	Sco	16 05 13.0	-38 57 39	6.60	6.67	V	ACV:	297	CoD
73403	VZ	CrB	16 14 29.8	+30 03 40	14.7	16.1	B	RRAB	124	124
73404	WW	CrB	16 15 15.7	+39 45 56	14.5	16.7	B	RRAB	126	126
73405	EW	Dra	16 16 39.6	+67 22 34	10.69	10.74	V	BY	018	148
73406	WX	CrB	16 17 30.3	+39 37 18	12.9	14.6	B	RRAB	126	126
73407	WY	CrB	16 19 29.6	+29 27 04	15.3	16.6	B	RRAB	124	124
73408	WZ	CrB	16 21 02.3	+39 18 19	15.8	17.1	B	RRAB	127	127
73409	XX	CrB	16 21 46.6	+28 03 39	15.12	15.35	V	EW	003	GSC
73410	V843	Her	16 22 24.8	+41 21 56	15.1	15.7	B	RRC	168	168
73411	V2304	Oph	16 22 52.8	-23 12 49	15.1	(18.	U	UVN	209	209
73412	V2305	Oph	16 23 14.8	-23 37 41	15.7	(18.	U	UVN	209	209
73413	V844	Her	16 23 17.8	+39 16 13	12.5	17.5	B	UG	168	168
73414	V845	Her	16 23 35.6	+41 00 35	14.3	15.5	B	CWA	126	126
73415	V355	Nor	16 23 55.5	-49 03 01	13.86	(0.02)	B	DSCTC	206	206
73416	V356	Nor	16 24 04.3	-49 04 04	13.06	(0.03)	B	DSCTC	206	206
73417	V357	Nor	16 24 07.0	-49 02 41	12.71	(0.01)	B	DSCTC	206	206
73418	V1028	Sco	16 24 21.7	-29 10 37	7.00	(0.01)	V	ACV	298	CoD
73419	V846	Her	16 24 50.2	+24 20 47	8.96	(0.06)	V	RS	005	BD
73420	V1029	Sco	16 25 21.9	-25 07 28	15.0	18.0	U	UV	299	299
73421	V1030	Sco	16 25 41.4	-25 48 23	15.6	(18.	U	UV	209	209
73422	V847	Her	16 26 06.4	+41 46 59	15.2	16.9	B	RRAB	126	126
73423	V2306	Oph	16 27 30.9	-12 32 18	10.05	10.10	V	BY	018	210
73424	V848	Her	16 29 46.0	+34 38 44	14.9	16.3	B	EB	127	127
73425	V1031	Sco	16 33 10.0	-26 12 14	12.0	(18.	U	UV	209	209
73426	V849	Her	16 33 24.6	+11 30 59	15.0	(0.5)	V	UG:	169	111
73427	V850	Her	16 33 35.2	+42 52 32	14.5	16.6	B	RRAB	126	126
73428	V851	Her	16 33 54.6	+41 12 54	15.1	16.4	B	RRAB	126	126
73429	V838	Ara	16 35 21.9	-53 58 45	11.	17.	V	M	030	030
73430	V852	Her	16 35 40.6	+27 05 58	14.4	15.8	B	RRAB	124	124
73431	V853	Her	16 35 50.8	+36 37 53	15.2	16.8	B	RRAB	168	168
73432	V854	Her	16 36 13.4	+34 26 26	14.7	15.8	B	EB:	127	127
73433	V855	Her	16 36 48.9	+41 17 33	15.2	17.3	B	RRAB	127	127
73434	V2307	Oph	16 37 16.5	-23 47 57	9.50	11.13	U	INA	211	CoD
73435	V856	Her	16 42 22.0	+39 29 02	12.8	13.8	B	EA	127	127
73436	V857	Her	16 45 10.8	+38 44 15	10.0	(0.29)	V	EW	170	042
73437	V858	Her	16 46 40.4	+40 33 56	15.1	16.5	B	RRAB	127	127
73438	V859	Her	16 48 03.3	+39 44 03	15.1	16.8	B	RRAB	126	126
73439	V860	Her	16 48 39.0	+28 03 43	14.73	15.74	V	RRAB	003	
73440	V861	Her	16 49 35.2	+41 22 58	13.8	14.2	B	EW	168	168

Table 1 (continued)

No.	Name	R.A.,Decl.,1950.0		Max	Min		Type	Ref.
		h m s	o ' ''	m	m			
73441	V1032 Sco	16 50 27.8	-41 43 50	9.90	(0.02)	B	BCEP	300 300
73442	V1033 Sco	16 50 33.2	-39 45 53	14.0	17.3	V	XND+E:	301 301
73443	V1034 Sco	16 50 49.0	-41 45 19	8.12	8.43	V	EA	300 300
73444	V862 Her	16 54 24.1	+40 13 41	13.2	13.6	B	RRC	168 168
73445	V863 Her	16 55 57.8	+41 36 18	13.6	14.5	B	RRAB	168 168
73446	V864 Her	16 57 01.2	+28 09 22	14.59	15.13	V	RRC:	003 GSC
73447	V865 Her	16 58 01.0	+42 01 49	13.0	14.1	B	EA	126 126
73448	V866 Her	16 58 13.3	+41 15 37	12.1	14.2	B	LB:	126 126
73449	V867 Her	16 58 40.9	+38 20 59	15.2	16.6	B	RRAB	168 168
73450	V868 Her	16 59 03.9	+36 13 10	15.9	17.3	B	RRAB	127 127
73451	V2308 Oph	17 00 17.7	-28 30 23	8.11	9.40	J	M	116
73452	V869 Her	17 00 35.2	+38 40 37	15.0	16.4	B	EA	168 168
73453	V870 Her	17 00 58.0	+39 36 39	14.8	16.4	B	RRAB	126 126
73454	V871 Her	17 05 14.2	+39 26 05	15.5	17.3	B	RRAB	127 127
73455	V872 Her	17 06 44.5	+40 01 36	15.1	16.2	B	EA	168 168
73456	V873 Her	17 06 50.5	+16 31 30	8.4	(0.21)	V	DSCT:	171 BD
73457	V874 Her	17 10 12.9	+48 54 03	9.9	10.9	P	EB:	172 172
73458	V839 Ara	17 11 56.3	-59 26 04	10.75:	10.95	V	BE	032 CPD
73459	V875 Her	17 13 54.8	+28 03 11	17.25	18.57	V	RRAB	003
73460	V1035 Sco	17 15 04.4	-34 21 22	9.27	(0.03)	V	WR	303 CoD
73461	V876 Her	17 17 37.7	+28 08 44	17.22	17.99	V	RRAB:	003
73462	V877 Her	17 19 29.6	+28 03 25	14.56	14.91	V	RRC	003 GSC
73463	V2309 Oph	17 20 50.0	-29 16 47	9.2 :	18. :	R	M	212 212
73464	V878 Her	17 23 09.3	+49 41 14	9.37	9.87	V	EB	173 BD
73465	V2310 Oph	17 26 17.5	-23 43 12	15.94	(0.03)	V	ZZ:	047 048
73466	V2311 Oph	17 26 57.3	-26 25 45	9. :	17.0	R	M	213 213
73467	V879 Her	17 29 14.3	+28 05 26	15.23	15.88	V	SXPHE	003
73468	V2312 Oph	17 30 12.9	+10 01 27	13.7	(1.08)	V	RRAB	214 214
73469	V1036 Sco	17 31 26.3	-32 32 57	5.71	5.79	V	ELL	304 CoD
73470	V2313 Oph	17 32 47.6	-19 17 42	7.5	(12.5	V	NA	215 216
73471	V1037 Sco	17 34 37.6	-35 21 21	9.62	9.83	V	PVTEL:	305 CoD
73472	V880 Her	17 40 22.9	+28 04 55	15.14	16.21	V	RRAB	003
73473	V881 Her	17 41 11.6	+28 05 44	16.04	16.96	V	RRAB	003
73474	V2314 Oph	17 41 36.9	+06 04 57	7.43	(0.08)	V	DSCTC	217 BD
73475	V2315 Oph	17 41 48.7	+05 44 06	8.28	8.34	V	ELL:	218 BD
73476	V882 Her	17 42 51.0	+28 02 15	15.43	15.84	V	RRC:	003
73477	V2316 Oph	17 42 52.4	+05 48 50	13.65	(0.05)	V	BY	219 220
73478	V2317 Oph	17 42 52.5	+05 38 04	12.71	(0.04)	V	BY	219 GSC
73479	V2318 Oph	17 42 58.2	+05 52 49	13.68	(0.08)	V	BY	219 220
73480	V2319 Oph	17 43 29.3	+05 23 40	12.65	(0.07)	V	BY	219 221
73481	V2320 Oph	17 43 43.8	+05 40 35	7.36	7.39	V	ELL:	218 BD
73482	V2321 Oph	17 43 44.9	+05 42 32	14.34	(0.16)	V	BY	219 222
73483	V2322 Oph	17 43 59.1	+05 50 48	12.92	(0.04)	V	BY	219 221
73484	V2323 Oph	17 44 09.8	+06 08 18	8.09	8.12	V	ELL:	218 BD

Table 1 (continued)

No.	Name		R.A.,	Decl.,1950.0	Max	Min		Type	Ref.
			h m s	o ' ''	m	m			
73485	V2324	Oph	17 44 19.5	+05 34 57	8.19	8.25	V	ELL:	218 BD
73486	V2325	Oph	17 45 06.0	+05 32 46	13.08	(0.11)	V	BY	219 221
73487	V2326	Oph	17 45 16.6	+05 22 59	13.41	(0.08)	V	BY	219 220
73488	V2327	Oph	17 46 16.3	+05 42 59	7.51	7.54	V	ELL:	218 BD
73489	V2328	Oph	17 48 30.9	+07 19 12	15.2	17.1	B	RRAB	223 223
73490	V1038	Sco	17 48 31.7	-42 13 22	8.06	9.57	J	M	116
73491	V883	Her	17 48 48.4	+28 01 34	13.13	13.35	V	EW	003 GSC
73492	V4334	Sgr	17 49 37.7	-17 40 29	10.90	21.	V	*	280 280
73493	V2329	Oph	17 49 50.0	+03 38 28	16.1	17.5	B	EA	224 224
73494	V4335	Sgr	17 55 08.1	-29 09 00	8.01	10.57	K	M	281
73495	V703	CrA	17 55 17.5	-39 09 06	10.55	14.04	H	M	116
73496	V4336	Sgr	17 55 55.0	-28 48 56	9.28	11.16	J	M	281
73497	V4337	Sgr	17 56 05.5	-29 16 11	8.67	12.64	J	M	281
73498	V4338	Sgr	17 56 07.2	-29 09 43	8.0	(14.	V	UG	282
73499	V4339	Sgr	17 56 38.7	-28 53 00	10.78	13.86	J	M	281
73500	V2330	Oph	17 57 21.0	+08 31 56	14.4	16.3	B	RRAB	224 224
73501	V4340	Sgr	17 57 49.9	-29 00 43	8.24	8.61	J	SRA	281
73502	V4341	Sgr	17 57 50.9	-29 14 03	7.27	8.37	K	M	281
73503	V2331	Oph	17 58 39.1	+08 43 37	15.1	16.5	B	RRAB	224 224
73504	V2332	Oph	17 59 25.3	+08 35 42	13.8	14.9	B	EB	224 224
73505	V2333	Oph	17 59 53.4	+08 56 51	13.3	16.1 :	B	M	223 223
73506	V884	Her	17 59 54.6	+18 04 38	14.5	(0.8)	V	XM	175 175
73507	V2334	Oph	18 01 48.4	+06 04 00	14.9	16.5	B	RRAB	223 223
73508	V2335	Oph	18 01 49.1	+04 43 31	15.0	(21.0	B	UG	223 223
73509	V2336	Oph	18 02 10.5	+08 19 34	14.0	15.0	B	RRAB	223 223
73510	V2337	Oph	18 03 01.1	+08 14 50	13.9	16.5	B	SRB	223 223
73511	V2338	Oph	18 03 04.5	+07 54 02	12.4	13.2	P	CWA:	225 225
73512	V2339	Oph	18 03 23.6	+07 27 20	13.5	14.3	B	ISB	224 224
73513	V885	Her	18 03 42.4	+21 25 57	10.62	(0.06)	V	BY	176 BD
73514	EX	Dra	18 04 24.7	+67 53 52	13.5	17.2	B	UG+E	149 GSC
73515	V2340	Oph	18 04 44.0	+08 22 20	14.3	16.5	B	SRA	223 223
73516	V2341	Oph	18 04 44.3	+07 19 44	12.8	13.8	B	LB	224 224
73517	V4342	Sgr	18 05 54.2	-31 55 52	16.3	17.5	B	RRAB	284 284
73518	V4343	Sgr	18 06 06.1	-31 46 18	16.2	17.6	B	RRAB	284 284
73519	V886	Her	18 06 16.3	+24 10 12	10.	11.5	P	BE:	177 177
73520	V4344	Sgr	18 06 29.6	-31 53 03	16.1	16.8	B	RRC	284 284
73521	V4345	Sgr	18 06 39.5	-31 57 53	16.2	17.6	B	RRAB	284 284
73522	V4346	Sgr	18 06 53.5	-32 00 53	16.1	16.7	B	RRAB	284 284
73523	V4347	Sgr	18 06 57.4	-32 02 22	16.2	17.9	B	RRAB	284 284
73524	V4348	Sgr	18 07 00.3	-31 55 31	16.6	17.8	B	RRAB	284 284
73525	V4349	Sgr	18 07 18.2	-31 54 16	16.3	17.5	B	RRAB	284 284
73526	V4350	Sgr	18 07 18.6	-31 37 17	16.1	16.9	B	RRAB	284 284
73527	V4351	Sgr	18 07 22.8	-31 56 03	17.1	17.7	B	RRAB	284 284
73528	V4352	Sgr	18 07 23.2	-31 35 24	16.2	17.6	B	RRAB	284 284

Table 1 (continued)

No.	Name		R.A.,Decl.,1950.0 h m s	° ' ''	Max m	Min m		Type	Ref.	
73529	V4353	Sgr	18 07 28.8	-31 58 51	16.3	17.4	B	RRAB	284	284
73530	V4354	Sgr	18 07 33.6	-31 48 48	15.1	15.7	B	RRAB	284	284
73531	V4355	Sgr	18 07 38.1	-31 54 07	16.0	17.4	B	RRAB	284	284
73532	V4356	Sgr	18 07 43.2	-31 28 10	16.9	17.9	B	RRC:	284	284
73533	V4357	Sgr	18 07 48.4	-32 03 57	15.8	17.6	B	RRAB	284	284
73534	V4358	Sgr	18 07 50.8	-31 53 53	16.0	17.2	B	RRAB	284	284
73535	V4359	Sgr	18 08 01.4	-31 56 28	15.7	16.5	B	RRC	284	284
73536	V887	Her	18 09 31.1	+27 04 30	12.09	12.33	U	SRD:	022	022
73537	V888	Her	18 09 32.5	+27 58 54	16.33	17.48	V	RRAB	003	
73538	V2342	Oph	18 10 06.5	+08 35 46	13.8	(17.3	B	M	223	223
73539	V2343	Oph	18 10 23.8	+07 51 40	14.6	(17.5	B	M:	224	224
73540	V2344	Oph	18 11 03.3	+08 51 34	13.4	15.6	B	SRA	223	223
73541	V2345	Oph	18 11 29.5	+09 03 44	14.0	16.0	B	RRAB	224	224
73542	V4360	Sgr	18 12 34.4	-31 07 18	13.3	15.6	P	CEP	286	328
73543	EY	Dra	18 15 15.6	+54 09 13	11.83	(0.09)	V	BY	152	153
73544	V2346	Oph	18 16 10.4	+08 04 25	13.2	14.5	B	RRAB	224	224
73545	V4361	Sgr	18 20 47.0	-18 08 52	10.6	(15.5	P	N	374	
73546	V346	Pav	18 20 47.2	-63 02 54	6.14	(0.04 b)	V	DSCTC	243	CPD
73547	V704	CrA	18 20 51.6	-44 13 36	7.90	7.93	V	DSCTC	117	CoD
73548	V446	Sct	18 23 43.1	-07 15 07	14.28	15.60	B	BE:	133	GSC
73549	NZ	Ser	18 25 01.4	-03 51 47	13.07	16.33	U	INA	311	312
73550	V2347	Oph	18 25 26.1	+07 50 23	5.8	6.9	K	M	029	
73551	OO	Ser	18 27 16.9	+01 14 16	11.4	16.1	K	FU:	313	313
73552	V4362	Sgr	18 27 28.6	-17 14 02	8.0	(15.0	V	NB	288	
73553	V4363	Sgr	18 28 16.5	-23 09 46	16.4	18.0	B	RRAB	289	289
73554	V4364	Sgr	18 28 27.7	-23 38 11	16.3	17.8	B	RRAB	289	289
73555	V4365	Sgr	18 28 47.5	-23 58 03	17.6	19.	B	LB:	289	289
73556	V4366	Sgr	18 28 48.8	-23 50 30	15.8	17.6	B	RRAB	289	289
73557	V4367	Sgr	18 28 58.5	-23 42 42	16.8	18.0	B	E	289	289
73558	V705	CrA	18 29 40.9	-40 57 18	18.15	18.48	V	EW	118	118
73559	V706	CrA	18 30 01.5	-40 59 56	18.90	19.57	V	EW	118	118
73560	V707	CrA	18 30 26.7	-41 01 29	16.15	16.37	V	EW	118	118
73561	V708	CrA	18 30 30 8	-41 03 42	17.55	17.90	V	EW	118	118
73562	V889	Her	18 32 08.8	+18 39 02	7.39	(0.14)	V	BY	005	BD
73563	V505	Lyr	18 34 37.4	+28 01 26	15.80	17.05	V	RRAB	003	
73564	V506	Lyr	18 37 49.4	+28 02 11	16.29	17.07	V	RRAB	003	
73565	V347	Pav	18 38 22.0	-74 21 37	14.85	16.67	V	AM	244	245
73566	V507	Lyr	18 38 49.8	+27 58 45	14.21	14.75	V	EW	003	GSC
73567	V508	Lyr	18 41 46.2	+27 58 56	16.20	16.61	V	EW:	003	
73568	V447	Sct	18 41 51.4	-07 09 46	7.85	(0.12)	V	BE	309	BD
73569	V509	Lyr	18 42 51.5	+27 57 14	16.89	17.37	V	EW:	003	
73570	V510	Lyr	18 46 17.8	+28 02 14	16.84	17.53	V	RRAB	003	
73571	V4368	Sgr	18 51 43.4	-19 45 46	10.0	(21.	V	NC:	291	292
73572	V709	CrA	18 58 12.4	-37 05 14	11.33	11.67	V	INB	119	120

Table 1 (continued)

No.	Name		R.A.,Decl.,1950.0 h m s	o ' ''	Max m	Min m		Type	Ref.	
73573	V710	CrA	18 58 28.5	-37 02 32	5.84	9.13	K	INB	121	122
73574	V4369	Sgr	19 02 31.5	-30 30 04	15.07	15.97	V	RRAB	118	118
73575	V1425	Aql	19 02 50.9	-01 46 40	7.5 :	(19.	V	NA	019	020
73576	V4370	Sgr	19 03 00.8	-30 36 03	19.27	19.75	V	EW	118	118
73577	V511	Lyr	19 04 21.5	+27 38 16	8.92	(0.08)	V	RS	005	BD
73578	V512	Lyr	19 04 54.1	+45 37 04	13.2	13.9	P	EA	190	190
73579	V1426	Aql	19 09 43.2	+04 18 36	9.3	(0.45)	B	EA	021	BD
73580	V1427	Aql	19 11 25.0	+00 02 19	10.48	10.88	U	SRD	022	BD
73581	V336	Sge	19 12 56.4	+17 37 39	9.4	(0.04)	V	DSCTC	279	BD
73582	V376	Vul	19 13 09.9	+25 07 39	10.3	11.3	r	SR	345	346
73583	V1428	Aql	19 14 29.1	+05 05 49	9.09	9.13	V	BY	018	BD
73584	V513	Lyr	19 18 40.0	+37 43 38	17.68	18.00	V	EW	191	191
73585	V514	Lyr	19 18 45.9	+37 46 16	17.64	17.79	V	EW	191	191
73586	V515	Lyr	19 18 48.1	+37 42 35	19.45	20.02	V	EA	191	191
73587	V516	Lyr	19 18 50.6	+37 39 11	18.9	22.2	V	UG	192	193
73588	V517	Lyr	19 18 57.5	+37 45 14	17.50	17.80	V	EA	191	191
73589	V518	Lyr	19 19 01.0	+37 43 05	17.18	17.29	V	EW:	192	191
73590	V519	Lyr	19 19 02.2	+37 38 49	16.20	16.62	V	EW	192	191
73591	V520	Lyr	19 19 02.4	+37 40 55	17.24	17.50	V	EA/RS:	192	191
73592	V521	Lyr	19 19 08.6	+37 42 40	17.77	17.94	V	EW	192	191
73593	V522	Lyr	19 19 16.8	+37 43 05	15.44	15.60	V	EW	191	191
73594	V1429	Aql	19 19 16.9	+14 47 13	11.46	12.26	U	SDOR:	023	BD
73595	V1430	Aql	19 19 19.6	+04 27 13	10.2	(0.80)	V	EA/RS	024	025
73596	V523	Lyr	19 19 21.4	+37 42 11	17.64	18.33	V	NL	191	191
73597	V524	Lyr	19 19 25.8	+37 42 13	19.55	19.98	V	EA	191	191
73598	V525	Lyr	19 19 29.8	+37 40 25	18.61	18.71	V	EW	191	191
73599	V526	Lyr	19 19 31.6	+37 40 15	19.66	19.93	V	EW	191	191
73600	V4371	Sgr	19 20 07.4	-14 21 21	9.42	9.60	V	BY	293	BD
73601	V377	Vul	19 20 48.0	+26 09 55	5.18	(0.03)	V	LBV	347	BD
73602	V4372	Sgr	19 25 44.8	-15 12 20	6.76	6.80	V	ELL:	294	BD
73603	V378	Vul	19 26 03.8	+19 27 09	14.3	14.8	B	WR	348	348
73604	V1431	Aql	19 26 29.3	+01 50 49	6.06	(0.04)	v	ACVO:	026	BD
73605	V4373	Sgr	19 36 11.9	-29 51 28	9.94	(0.01 B)	V	ACVO	295	CoD
73606	V1432	Aql	19 37 26.5	-10 32 24	14.2	18.	V	XM+E	027	028
73607	V1433	Aql	19 38 39.0	+15 13 16	3.7	4.7	K	M	029	
73608	V337	Sge	19 45 55.1	+17 16 33	7.3	9.3	K	M	029	
73609	V379	Vul	19 47 53.1	+28 18 44	6.22	6.29	V	ELL	349	BD
73610	V380	Vul	19 48 06.5	+26 19 15	13.0	15.0	V	SR	350	350
73611	QT	Tel	19 52 07.2	-51 31 28	8.98	9.33	J	SR	033	GSC
73612	V348	Pav	19 52 30.7	-60 42 28	18.0	19.0	P	NL	015	015
73613	V2028	Cyg	19 54 33.0	+30 58 16	11.68	12.40	U	BE	133	GSC
73614	V349	Pav	20 04 17.9	-65 36 08	18.0	19.5	P	AM	246	246
73615	QU	Tel	20 05 52.5	-52 34 07	14.93	(0.05)	V	ZZB	332	332
73616	AX	Cap	20 06 05.5	-17 25 28	18.3	21.5	V	UG:	063	064

Table 1 (continued)

No.	Name		R.A.,Decl.,1950.0 h m s ° ′ ″	Max m	Min m		Type	Ref.
73617	V381	Vul	20 08 40.1 +26 35 38	10.23	(0.03)	V	DSCTC	351 241
73618	V382	Vul	20 09 13.0 +26 22 19	10.49	(0.03)	V	DSCTC	351 241
73619	EZ	Dra	20 09 39.5 +66 48 14	11.2	14.2	P	M	154 154
73620	V350	Pav	20 13 35.7 -71 52 53	3.81	5.90	J	M	014 106
73621	V383	Vul	20 14 14.7 +22 14 29	7.2	(0.03 v)	V	DSCTC	279 BD
73622	V4374	Sgr	20 14 55.4 -28 17 21	8.87	9.22	V	EA:	296 296
73623	CM	Oct	20 16 49.5 -78 49 14	6.36	7.70	J	M	014
73624	V2029	Cyg	20 21 22.9 +47 27 33	16.0	17.1	B	SR	134 134
73625	V2030	Cyg	20 21 27.8 +50 39 38	14.4	15.5	V	SRB	134 134
73626	V2031	Cyg	20 22 00.3 +38 19 50	8.53	8.67	V	EA	135 135
73627	AY	Cap	20 27 09.8 -23 40 46	6.36	6.88	J	SR	033 GSC
73628	V2032	Cyg	20 29 16.6 +46 11 33	13.0	14.3	V	SRB	134 134
73629	V2033	Cyg	20 29 57.1 +46 37 47	15.9	16.7	B	LB	134 134
73630	V2034	Cyg	20 32 06.7 +49 09 31	10.7	11.8	V	SRA	134 134
73631	V2035	Cyg	20 33 47.2 +45 18 53	11.7	12.6	V	SRB	134 134
73632	V2036	Cyg	20 35 58.6 +49 46 48	14.9	15.8	V	SRB	134 134
73633	LW	Del	20 36 02.0 +09 01 30	12.8	(1.05)	V	RRAB	144 144
73634	V2037	Cyg	20 36 05.2 +48 45 56	10.9	12.1	V	SRB	134 134
73635	V2038	Cyg	20 37 18.2 +50 23 14	14.0	14.7	V	SRB	134 134
73636	HX	Aqr	20 37 37.0 -01 06 15	11.86	(12.30	V	E	013 GSC
73637	V2039	Cyg	20 43 09.2 +46 52 13	16.4	17.9	B	LB	134 134
73638	V2040	Cyg	20 43 58.9 +43 18 18	15.2	16.4	B	SRB	134 134
73639	BO	Mic	20 44 34.0 -36 46 42	9.2	(0.21)	V	BY	196 CoD
73640	V2041	Cyg	20 46 52.2 +45 36 14	14.5	(18.	U	UVN	136 136
73641	V2042	Cyg	20 47 39.3 +46 37 02	16.5	17.5	B	LB	134 134
73642	V351	Pav	20 48 29.3 -72 02 48	4.02	5.97	J	M	014
73643	V2043	Cyg	20 49 28.3 +40 42 33	15.9	20.0	P	UVN	137 138
73644	LX	Del	20 49 51.3 +06 57 26	13.7	(0.8)	V	RRAB	145 145
73645	V2044	Cyg	20 50 45.4 +46 13 30	12.0	14.7	V	M:	139 139
73646	V2045	Cyg	20 50 52.7 +45 08 56	15.2	15.9	V	SRB	134 134
73647	V2046	Cyg	20 51 24.5 +53 32 00	15.3	17.3	V	SRB	134 134
73648	V2047	Cyg	20 53 07.1 +42 46 02	14.5	18.	U	UVN	136 136
73649	V2048	Cyg	20 53 12.1 +42 53 20	15.6	16.4	U	UVN	136 136
73650	AZ	Cap	20 53 13.8 -17 22 23	10.40	10.50	V	BY+UV	065 065
73651	V2049	Cyg	20 53 22.0 +43 11 04	14.8	17.6	U	UVN	136 136
73652	V2050	Cyg	20 53 31.5 +39 12 13	14.42	14.76	V	EW	140 140
73653	V2051	Cyg	20 56 00.1 +43 38 45	14.0	(18.	U	UVN	136 136
73654	BP	Mic	20 57 11.8 -37 06 55	3.79	4.48	H	M	014
73655	V2052	Cyg	20 59 10.0 +42 47 57	13.7	17.4	U	UVN	136 136
73656	V2053	Cyg	21 00 37.8 +45 56 03	16.0	17.2	B	LB	134 134
73657	V2054	Cyg	21 01 29.9 +43 57 37	15.3	16.3	V	LB:	134 134
73658	V2055	Cyg	21 01 41.9 +54 02 18	15.3	16.2	V	LB	134 134
73659	V2056	Cyg	21 01 49.1 +44 56 00	14.9	15.5	V	LB	134 134
73660	LY	Del	21 04 08.6 +19 12 32	10.40	13.5	V	EA	146 146

Table 1 (continued)

No.	Name		R.A.,Decl.,1950.0						Max	Min		Type	Ref.	
			h	m	s	o	'	''	m	m				
73661	V2057	Cyg	21	05	20.0	+42	13	30	14.2	15.9	U	UVN	136	136
73662	V384	Vul	21	05	39.1	+27	53	23	12.72	13.16	V	EW	003	GSC
73663	V2058	Cyg	21	05	57.4	+43	29	45	15.4	16.7	B	SR	134	134
73664	V2059	Cyg	21	06	17.5	+46	19	04	16.6	17.5	B	LB	134	134
73665	BQ	Mic	21	06	57.1	-38	43	18	3.45	4.74	J	M	014	
73666	V2060	Cyg	21	08	12.4	+53	58	16	14.7	15.7	V	SR	134	134
73667	V2061	Cyg	21	09	02.0	+44	07	57	12.5	13.2	R	LB	134	134
73668	V2062	Cyg	21	10	28.9	+52	55	20	16.0	17.5	R	UV:	141	141
73669	V2063	Cyg	21	11	05.1	+44	30	26	17.8	18.8	B	LB	134	134
73670	V2064	Cyg	21	11	35.1	+54	06	06	17.1	18.7	B	LB	134	134
73671	V2065	Cyg	21	11	36.4	+41	41	58	15.9	17.4	B	SR	134	134
73672	V2066	Cyg	21	14	28.2	+42	04	45	15.1	16.8	B	LB	134	134
73673	V2067	Cyg	21	15	10.1	+50	10	47	13.2	14.3	V	LB	134	134
73674	V385	Vul	21	18	33.1	+27	56	35	16.33	16.65	V	RRC:	003	
73675	iota	Cap	21	19	27.9	-17	02	55	4.27	(0.06)	V	BY	005	BD
73676	V386	Vul	21	19	32.0	+27	56	20	15.15	15.58	V	RRC	003	
73677	V2068	Cyg	21	19	40.5	+54	53	40	12.0	13.3	R	LB	134	134
73678	V2069	Cyg	21	21	49.5	+42	05	07	15.70	15.95	V	NL:	068	068
73679	BR	Mic	21	24	01.2	-32	09	23	8.78	8.82	V	BCEP	197	CoD
73680	V2070	Cyg	21	25	00.4	+52	06	09	19.1	20.2	B	LB	134	134
73681	CH	Gru	21	25	23.2	-42	45	37	18.3	19.8	B	NL	165	166
73682	HY	Aqr	21	28	27.3	-07	47	35	4.69	6.15	H	M	014	GSC
73683	BB	Cap	21	28	33.7	-10	00	38	11.96	11.99	V	BY	018	066
73684	V389	Cep	21	28	37.2	+55	39	20	13.1	15.3	P	ISA:	095	095
73685	LO	Peg	21	28	45.0	+23	06	59	9.04	9.27	V	BY	248	237
73686	V2071	Cyg	21	28	50.9	+49	38	04	12.9	13.8	V	LB	134	134
73687	V2072	Cyg	21	29	13.8	+38	33	17	11.8	17.8	P	M	142	139
73688	HZ	Aqr	21	29	36.9	-00	00	00	9.89	(0.07)	V	RS	005	BD
73689	CI	Gru	21	29	56.2	-42	42	13	16.4	18.5	B	UG	165	166
73690	V2073	Cyg	21	30	06.7	+52	55	32	17.8	18.4	B	LB	134	134
73691	LP	Peg	21	32	50.4	+27	51	53	16.70	17.28	V	EW	003	
73692	LQ	Peg	21	33	53.5	+11	27	26	14.0	17.5	B	NL	249	111
73693	V390	Cep	21	35	18.4	+57	17	40	13.	16.2	B	INB	096	097
73694	V391	Cep	21	39	21.9	+66	21	40	14.9	17.0	B	INT	098	098
73695	V2074	Cyg	21	41	43.3	+48	55	11	13.3	14.7	V	LB	134	134
73696	V392	Cep	21	41	48.5	+65	50	36		(1.2)	r	INT	099	099
73697	LR	Peg	21	44	31.1	+27	50	32	14.76	15.46	V	RRAB	003	
73698	V393	Cep	21	48	49.0	+59	22	51	12.2	14.8	P	ISA:	095	095
73699	LS	Peg	21	49	33.1	+13	52	47	11.6	13.0	V	UG:	250	111
73700	V2075	Cyg	21	53	14.7	+44	10	53	7.46	(0.36)	V	RS	005	BD
73701	V2076	Cyg	21	55	25.4	+38	10	04	12.3	15.2	V	SRD	011	011
73702	LT	Peg	21	55	53.8	+27	51	52	16.29	17.76	V	RRAB	003	
73703	LU	Peg	21	56	34.8	+27	48	58	14.58	15.61	V	RRAB	003	
73704	LV	Peg	21	58	56.8	+08	21	57	6.18	6.95	J	M	014	GSC

Table 1 (continued)

No.	Name		R.A.,Decl.,1950.0 h m s	° ′ ″	Max m	Min m		Type	Ref.	
73705	LW	Peg	21 59 12.8	+27 49 29	14.96	16.01	V	RRAB	003	
73706	LX	Peg	22 01 02.6	+27 48 10	13.83	14.09	V	EW	003	GSC
73707	V394	Cep	22 01 02.8	+59 12 37	14.2	16.1	P	CWB:	095	095
73708	V378	Lac	22 01 27.5	+45 19 33	8.7	9.1	R	LB	134	134
73709	LY	Peg	22 03 25.5	+11 47 25	11.34	11.52	V	EB	251	251
73710	V379	Lac	22 05 48.1	+40 50 30	12.1	15.2	V	M	011	011
73711	V380	Lac	22 08 06.3	+38 00 59	11.7	15.1	V	M	011	011
73712	LZ	Peg	22 08 39.9	+27 53 10	15.88	16.83	V	RRAB	003	
73713	II	Aqr	22 13 42.7	-20 42 24	19.0	21.5	P	NL	015	015
73714	V381	Lac	22 13 52.1	+42 07 56	12.5	(16.2	V	NL:	011	011
73715	V382	Lac	22 17 36.4	+47 58 14	12.3	14.1	V	SR	011	011
73716	V383	Lac	22 18 06.0	+49 15 05	8.9	(0.19)	V	BY+UV	182	BD
73717	MM	Peg	22 18 52.4	+27 48 18	15.03	15.33	V	EW	003	
73718	V384	Lac	22 21 25.4	+47 29 20	13.8	15.2	V	SR	011	011
73719	IK	Aqr	22 23 04.8	-11 28 46	20.2	(0.35)	P	NL	016	017
73720	V385	Lac	22 23 39.8	+50 02 59	12.2	15.6	V	M	011	011
73721	UV	PsA	22 27 23.7	-30 41 44	8.6	(0.07)	B	DSCTC	067	CoD
73722	V386	Lac	22 27 49.1	+45 31 32	12.5	15.0	V	M	011	011
73723	MN	Peg	22 28 43.8	+06 07 23	11.5	(15.5	P	M	252	GSC
73724	V387	Lac	22 29 29.1	+48 00 34	11.0	14.6	V	M	011	011
73725	UW	PsA	22 30 45.4	-29 55 23	8.2	(0.08)	B	DSCTC	067	CoD
73726	MO	Peg	22 34 33.2	+27 46 57	16.84	17.54	V	RRAB	003	
73727	V388	Lac	22 38 56.3	+40 18 29	10.6	15.2	V	M	011	011
73728	MP	Peg	22 40 17.8	+10 45 09	6.15	7.19	J	M	014	GSC
73729	V389	Lac	22 41 06.8	+41 01 35	9.7	14.0	V	M	011	011
73730	V390	Lac	22 43 07.7	+50 36 07	12.8	(15.2	V	M	011	011
73731	MQ	Peg	22 45 47.8	+27 49 27	13.39	13.67	V	EW	003	GSC
73732	V391	Lac	22 47 28.1	+52 02 17	11.8	15.2	V	M	011	011
73733	V392	Lac	22 48 09.2	+53 08 23	12.2	14.3	V	SRA	011	011
73734	IL	Aqr	22 50 34.7	-14 31 14	10.15	10.19	V	BY	018	BD
73735	MR	Peg	22 51 46.4	+22 23 35	5.71	7.28	J	M	014	GSC
73736	MS	Peg	22 56 22.4	+24 59 42	13.68	(0.10)	V	NL	253	254
73737	QZ	And	22 56 53.2	+48 51 53	12.9	15.0	V	SR	011	011
73738	V335	And	22 59 42.9	+39 43 42	11.8	14.5	V	M	011	011
73739	V336	And	23 00 05.3	+41 27 27	11.6	(15.0	V	M:	011	011
73740	MT	Peg	23 00 38.0	+20 38 58	7.30	(0.02)	U	BY	255	BD
73741	MU	Peg	23 03 30.8	+27 53 34	16.23	17.48	V	RRAB	003	
73742	MV	Peg	23 05 09.3	+23 30 42	6.08	7.31	J	M	014	
73743	MW	Peg	23 08 01.5	+34 30 01	11.7	12.4	P	SR	256	256
73744	BI	Ind	23 10 43.7	-68 33 49	7.65	7.70	V	RS	181	CPD
73745	CP	Tuc	23 12 22.2	-59 26 34	14.1	16.1	I	XM	333	
73746	V728	Cas	23 13 20.2	+61 35 35	8.1	(0.06)	V	RS:	082	BD
73747	V337	And	23 14 03.0	+38 27 36	11.3	14.4	V	SRD	011	011
73748	V395	Cep	23 18 59.0	+73 57 40	9.5	(0.08)	V	INT	100	GSC

Table 1 (continued)

No.	Name		R.A.,Decl.,1950.0 h m s	° ' ''	Max m	Min m		Type	Ref.
73749	MX	Peg	23 19 47.3	+27 49 05	16.23	16.71	V	EW	003
73750	BP	Psc	23 19 50.3	-02 30 08	9.04	9.84	J	IT	033 GSC
73751	CK	Gru	23 21 22.2	-45 21 27	2.83	4.51	J	M	014 GSC
73752	V338	And	23 23 18.5	+45 25 33	12.0	(14.0	V	M	011 011
73753	MY	Peg	23 30 14.8	+27 49 45	16.65	17.66	V	RRAB	003
73754	V339	And	23 31 42.1	+46 03 29	11.3	(15.0	V	M	011 011
73755	V340	And	23 32 10.4	+39 57 38	5.59	(0.007v)	V	DSCTC	012 BD
73756	BQ	Psc	23 45 44.0	+00 37 44	17.99	18.57	V	SXPHE	272 272
73757	BR	Psc	23 46 35.6	+02 08 12	8.93	9.03	V	BY	018 066
73758	BS	Psc	23 49 50.5	-01 12 42	10.66	(0.16)	V	BY	005 BD
73759	MZ	Peg	23 50 31.7	+27 48 48	17.08	17.89	V	RRAB	003
73760	V729	Cas	23 51 31.5	+61 47 37	12.89	13.03	V	E	062 062
73761	V730	Cas	23 54 15.0	+56 26 42	14.53	14.60	V	EW	083 083
73762	V731	Cas	23 54 28.4	+56 28 26	19.09	19.46	V	EA	083 083
73763	V732	Cas	23 54 38.1	+56 25 36	14.26	14.42	V	EW	083 083
73764	V733	Cas	23 54 52.5	+56 28 31	15.92	16.03	V	EB	083 083
73765	V734	Cas	23 54 53.7	+56 26 51	15.18	15.41	V	EB	083 083
73766	V735	Cas	23 54 58.9	+56 23 07	14.04	14.08	V	DSCTC	083 083
73767	V736	Cas	23 55 01.5	+56 27 51	14.81	14.97	V	EW	083 083
73768	V737	Cas	23 55 17.3	+56 30 18	16.69	16.86	V	EW	083 083
73769	V738	Cas	23 55 25.0	+56 29 06	19.30	19.71	V	EW	083 083
73770	BT	Psc	23 57 00.8	-02 07 43	7.8	(0.09)	B	IB:	273 BD
73771	BU	Psc	23 59 28.7	-03 02 41	6.9	(0.06)	B	IB:	273 BD

Table 2

QR	And =	73007	= RX J0019.8+2156 [001, 002] = GSC 1185.1428.
QS	And =	73008	= No.1 [003].
QT	And =	73021	= BD+33°94 (9.5) [004] = RE 0041+342 = 2RE J004117+342547 = GSC 2283.1157.
QU	And =	73031	= HD 7205 (G5) = BD+40°248 (7.0) = SAO 037026 = IRAS 01102+4123 = LTT 10444 = G 132-62 = HIC 005684 [005] = GSC 2808.0447.
QV	And =	73034	= HR 369 [006] = HD 7546 (B8) = BD+47°357 (6.5) = SAO 037067 = GSC 3268.0835.
QW	And =	73035	= GSC 3273.0761 [007].
QX	And =	73040	= Hein 235 (NGC 752) [008] = GSC 2816.1950.
QY	And =	73043	= No.2 [010] = SVS 2886 = GSC 3289.1992. ≠ LM And = No.1 [010].
QZ	And =	73737	= LD 212 [011].
V335	And =	73738	= LD 214 [011] = IRAS 22597+3943 = GSC 3220.2872.
V336	And =	73739	= LD 215 [011] = GSC 3224.1028.
V337	And =	73747	= LD 217 [011] = IRAS 23140+3827 = GSC 3217.1369.
V338	And =	73752	= LD 218 [011] = IRAS 23233+4525.
V339	And =	73754	= LD 220 [011] = IRAS 23317+4603 = Prager 2405 = Ross var 101 = CSV 5756 = NSV 14621.
V340	And =	73755	= 15 And = HR 8947 = HD 221756 (A0) [012] = BD+39°5114 (6.0) = SAO 073346 = NSV 14627 = GSC 3235.1512.
AK	Ant =	73261	= HD 83041 (A0) [012] = CoD−28°7417 (8.3) = CPD−28°3780 (8.2) = SAO 177696 = GSC 6613.0532.
HX	Aqr =	73636	= Comparison star for AE Aqr, ~3!4, P.A.170° [013] = GSC 5177.1637.
HY	Aqr =	73682	= IRAS 21284–0747 [014] = GSC 5786.0021.

Table 2 (continued)

HZ	Aqr =	73688	= BD−0°4234 (9.2) [005] = LDS 749A = G 26-9 = LTT 16295 = EUVE J2132+00.2 = NSV 13768 = GSC 0542.0217.
II	Aqr =	73713	= V 2216-2027 [015].
IK	Aqr =	73719	= Var 7 [016, 017] = PHL 1889 = CSV 8759 = NSV 14152.
IL	Aqr =	73734	= BD−15°6290 (9.5) = Gliese 876 [018] = G 156-57 = LHS 530 = LFT 1745 = Ross 780 = GSC 5819.0957.
V1425	Aql =	73575	= Nova Aql 1995 [019, *Takamizawa*].
V1426	Aql =	73579	= HD 179376 (G0) [021] = BD+4°4010 (9.0) = SAO 124378 = SVS 1070 = CSV 8122 = NSV 11802 = GSC 0471.2131.
V1427	Aql =	73580	= HD 179821 (G5) [022] = BD−0°3679 (8.1) = SAO 124414 = IRAS 19114+0002 = AFGL 2343 = HIP 094496 = GSC 0463.3866.
V1428	Aql =	73583	= HD 180617 (Ma) = BD+4°4048 (9.2) = Gliese 752A [018] = G 22-22 = LHS 473 = LFT 1466 = Ross 652 = GSC 0472.1252.
V1429	Aql =	73594	= BD+14°3887 (9.5) = IRAS 19192+1447 = MWC 314 [023] = He 3-1745 = LS II+14°11 = GSC 1054.0441.
V1430	Aql =	73595	= 1E 1919+0427 [024] = GSC 0472.2839.
V1431	Aql =	73604	= 35 Aql = HR 7400 = HD 183324 (A0) [026] = BD+1°4010 (6.3) = SAO 124675 = GSC 0469.6229.
V1432	Aql =	73606	= RX J1940.1–1025 = RX J1940.2-1025 [027].
V1433	Aql =	73607	= IRAS 19386+1513 [029].
V838	Ara =	73429	= IRAS 16353–5358 [030] = $16^h31^m21\overset{s}{.}6$ −52°52'37" (1900) [031].
V839	Ara =	73458	= CoD−59°6479 (9.3) = CPD−59°6926 (8.9) = SAO 244567 = IRAS 17119-5926 = He 3-1357 = Wray 15-1654 = NSV 08382 = GSC 8739.0311.
XZ	Ari =	73049	= No.6 [003] = GSC 1775.0043.
YY	Ari =	73052	= IRAS 02404+2150 [033] = GSC 1229.1250. H_2O, OH maser.
YZ	Ari =	73055	= IRAS 02547+1106 [014] = AFGL 5087.
V402	Aur =	73143	= HD 282719 (F0) = BD+31°849 (8.5) [034] = SAO 057590 = HIP 023433 = GSC 2388.1048.
V403	Aur =	73204	= HR 2054 = HD 39743 (G5) = BD+49°1423 (6.5) = SAO 040720 = IRAS 05532+4901 = HIC 028162 [005] = GSC 3369.0858.
V404	Aur =	73205	= Wr 123 [035,036] = CSV 6411 = NSV 02733 = GSC 2924.1750.
V405	Aur =	73206	= RX J0558+53 = RX J0558.0+5353 [037] = GSC 3750.0721.
V406	Aur =	73212	= HD 43478 (A3p) [038] = BD+32°1246 (8.0) = SAO 058954 = HIP 029911 = GSC 2424.0106.
CY	Boo =	73371	= 101 Vir = HR 5352 [039] = HD 125180 (Ma) = BD+15°2690 (6.2) = SAO 100956 = IRC+20271 = IRAS 14150+1529 = HIP 069829 = NSV 06613 = GSC 1469.1456.
CZ	Boo =	73374	= No.25 [003].
DD	Boo =	73378	= HV 10431 [040] = CSV 2213 = NSV 06836 = GSC 2016.0004.
DE	Boo =	73380	= HR 5553 = HD 131511 (K0) = BD+19°2881 (6.3) = SAO 101276 = IRAS 14511+1921 = Gliese 567 = LFT 1153 = LTT 14413 = HIC 072848 [005] = NSV 06847 = GSC 1481.0694.
DF	Boo =	73381	= No.26 [003] = HV 10434 = CSV 2220 = NSV 06854 = GSC 2023.0268.
DG	Boo =	73386	= BV 100 [041,042] = CSV 7180 = NSV 07020 = GSC 3482.0620.
RS	Cae =	73142	= RX J0453.4–4213 [043].
CE	Cam =	73078	= HR 1040 [044] = HD 21389 (A0p) = BD+58°607 (5.0) = SAO 024061 = IRC+60120 = IRAS 03258+5842 = HIP 016281 = GSC 3715.1250.
CF	Cam =	73085	= V3 [045] = SVS 2686 = GSC 3728.1092.
CG	Cam =	73097	= IRAS 03448+6801 = GSC 4327.1109 [046].
CH	Cam =	73104	= PNN of NGC 1501 [047] = PK 144 + 6°1 = IRAS 04026+6047.
CI	Cam =	73115	= MWC 84 [049] = LS V+55°16 = IRAS 04156+5552 = GSC 3723.0200.
CK	Cam =	73144	= HD 32456 (G5) = BD+55°956 (7.4) = SAO 025009 [050] = IRAS 05023+5517 = HIP 023768 = GSC 3738.0234.
CL	Cam =	73147	= HD 33363 (G5) = BD+75°217 (7.6) = SAO 005481 = IRAS 05116+7553 = HIC 024760 [005] = GSC 4511.0980.
CM	Cam =	73223	= HD 51066 (G5) = BD+75°280 (7.0) = SAO 006053 = IRAS 06575+7529 = HIC 034101 [005] = 1E 0657.6+7529 = GSC 4526.1506.

Table 2 (continued)

CN	Cam =	73286	= BD+82°338 (9.0) = SAO 001900 = BV 367 = CSV6845 = NSV 05256 = GSC 4556.0251.
CO	Cam =	73294	= HR 4646 [052] = HD 106112 (A5) = BD+78°412 (5.1) = SAO 007522 = IRAS 12098+7753 = HIP 059504 = GSC 4553.1680.
FI	Cnc =	73238	= HD 72146 (G5) = BD+29°1772 (7.5) = SAO 080232 = IRAS 08292+2929 = HIC 041875 [005] = GSC 1947.0489.
FK	Cnc =	73239	= HD 72429 (G0) = BD+11°1865 (8.0) = SAO 097905 = 1E 0830.3+1126 = HIC 041951 [005] = GSC 0804.0682.
FL	Cnc =	73244	= HD 74292 (A2) [053] = BD+32°1782 (6.8) = SAO 061019 = GSC 2484.1690.
FM	Cnc =	73246	= No.11 [003].
FN	Cnc =	73251	= No.12 [003].
BQ	CVn =	73353	= HD 112859 (K0) = BD+47°2007 (7.8) = SAO 044410 = HIC 063368 [005] = GSC 3459.1053.
BR	CVn =	73358	= HD 116475 (Mb) [054] = BD+47°2053 (7.0) = SAO 044590 = IRC+50227 = AFGL 1618 = IRAS 13209+4715 = HIP 065309 = GSC 3460.2120.
HY	CMa =	73210	= BD−16°1396 (9.1) = SAO 151224 [055] = 2RE J061238-164838 = GSC 5933.1801.
HZ	CMa =	73220	= HR 2545 = HD 50123 (B8) = CoD−31°3717 (6.3) = CPD−31°1334 (6.3) = SAO 197263 = IDS 0646.6S3135A = IRAS 06484-3135 = MWC 157 [056] = He 3-19 = HIP 032810 = GSC 7088.2598.
II	CMa =	73221	= var#1 [057]. Probable non-member of the open cluster Be 33.
IK	CMa =	73222	= var#2 [057]. Probable member of the open cluster Be 33.
IL	CMa =	73225	= HR 2680 [058] = HD 54031 (B8) = CoD−30°3907 (6.8) = CPD−30°1526 (7.2) = SAO 197566 = HIP 034248 = GSC 7090.1305.
IM	CMa =	73226	= Star 34 (NGC 2362) [059] = CPD−24°2236 (9.4).
IN	CMa =	73227	= RE 0720-318 [061] = EUVE J0720-31.7 = EXOSAT 0718-312.
BM	CMi =	73232	= Anon CMi [062] = GSC 0192.0067.
AX	Cap =	73616	= New CV 2006–17 [063] = 2006–1725.
AY	Cap =	73627	= IRAS 20271–2340 [033] = GSC 6907.1948.
AZ	Cap =	73650	= EUVE J2056–17.1 [065] = BD−17°6128 (9.9) = GSC 6349.0200.
BB	Cap =	73683	= Gliese 831 [018] = G 26-7 = LHS 511 = LTT 8556 = NSV 13753 = GSC 5790.0182.
ι	Cap =	73675	= iota Cap = 32 Cap = HR 8167 = HD 203387 (K0) = BD−17°6245 (4.2) = SAO 164346 = IRC–20599 = IRAS 21194–1702 = HIC 105515 [005] = GSC 6360.1220.
V435	Car =	73215	= HD 44958 (A2) [067] = CoD−51°1874 (6.8) = CPD−51°898 (7.0) = SAO 234463 = GSC 8114.1488.
V436	Car =	73230	= RX J0744.9–5257 [068] = GSC 8552.0902.
V437	Car =	73266	= HD 86181 (F0) [069] = CoD−58°2889 (9.1) = CPD−58°1700 (8.9) = SAO 237494 = GSC 8610.0420.
V438	Car =	73272	= No.87 (NGC 3293) [070].
V439	Car =	73273	= No.60 (NGC 3293) [070] = GSC 8613.3020.
V440	Car =	73274	= No.133 (NGC 3293) [070,353] = CPD−57°3515 (8.8) = GSC 8613.2626.
V441	Car =	73276	= No.194 (NGC 3293) [070].
V442	Car =	73280	= No.74 (NGC 3496) [071] = GSC 8958.1915.
V443	Car =	73281	= No.214 (NGC 3496) [071].
V706	Cas =	73002	= LD 76 [072] = No.1 [073] = IRAS 00049+6426.
V707	Cas =	73003	= LD 77 [072] = IRAS 00056+5229.
V708	Cas =	73004	= LD 78 [072] = IRAS 00085+6402.
V709	Cas =	73009	= RX J0028.8+5917 [068].
V710	Cas =	73010	= RNO 1B [074] = IRAS 00338+6312.
V711	Cas =	73011	= C3-V36 (Gal.NGC 185) [075] = NGC 185 V0049. Foreground object?
V712	Cas =	73012	= C3-V28 (Gal.NGC 185) [075] = NGC 185 V0063. Foreground object?
V713	Cas =	73013	= C3-V26 (Gal.NGC 185) [075] = NGC 185 V0069. Foreground object?
V714	Cas =	73014	= C4-V15 (Gal.NGC 185) [075] = NGC 185 V0070. Foreground object?
V715	Cas =	73015	= C1-V22 (Gal.NGC 185) [075] = NGC 185 V0155. Foreground object?
V716	Cas =	73016	= C1-V12 (Gal.NGC 185) [075] = NGC 185 V0165. Foreground object?
V717	Cas =	73017	= C1-V13 (Gal.NGC 185) [075] = NGC 185 V0166. Foreground object?
V718	Cas =	73018	= C1-V9 (Gal.NGC 185) [075] = NGC 185 V0168. Foreground object?

Table 2 (continued)

V719	Cas =	73019	= C1-V1 (Gal.NGC 185) [075] = NGC 185 V0174. Foreground object?
V720	Cas =	73023	= TAV 0042+53 = IRAS 00422+5310 [077] = GSC 3655.1254.
V721	Cas =	73026	= LD 90 [072] = IRAS 00535+5923.
V722	Cas =	73028	= LD 94 [072] = IRAS 00563+6028 = CCS 44 = GSC 4017.1463. Not AV Cas.
V723	Cas =	73030	= Nova Cas 1995 [078, *Yamamoto*].
V724	Cas =	73032	= LD 96 [072] = GSC 4034.0172.
V725	Cas =	73048	= M 285 [080].
V726	Cas =	73051	= M 295 [080].
V727	Cas =	73057	= Prager 2552 = 634.1936 = IRAS 02588+6956 = CSV 263 = NSV 01020 [081] = GSC 4317.0077.
V728	Cas =	73746	= BD+61°2409 (8.3) = SAO 020517 [082] = HIP 114817 = GSC 4279.0146.
V729	Cas =	73760	= GSC 4285.1790 [062].
V730	Cas =	73761	= No.6 [083] = GSC 4009.0677. In NGC 7789 field.
V731	Cas =	73762	= No.9 [083]. In NGC 7789 field.
V732	Cas =	73763	= No.1 [083]. In NGC 7789 field.
V733	Cas =	73764	= No.7 [083]. In NGC 7789 field.
V734	Cas =	73765	= No.8 [083]. In NGC 7789 field.
V735	Cas =	73766	= No.10 (NGC 7789) [083].
V736	Cas =	73767	= No.2 [083]. In NGC 7789 field.
V737	Cas =	73768	= No.4 [083]. In NGC 7789 field.
V738	Cas =	73769	= No.5 [083]. In NGC 7789 field.
V885	Cen =	73287	= HD 101584 (G0) [084] = CoD−54°4274 (7.0) = CPD−54°4707 (8.0) = SAO 239288 = IRAS 11385-5517 = HIP 056992 = GSC 8634.1166. Close binary eccentric system with a low-mass unseen secondary and a post-AGB primary. Long-term variations plus periodic variability.
V886	Cen =	73338	= BPM 37093 [085] = L 327-186 = WD 1236-495 = Gliese 2095 = LHS 2594 = LTT 4816 = GSC 8240.2502.
V887	Cen =	73340	= V2 [087]. In the globular cluster Ru 106, a background object.
V888	Cen =	73354	= Nova Cen 1995 [088, *Liller*].
V889	Cen =	73359	= LSS 3074 [089] = GSC 8995.3316.
V890	Cen =	73362	= V 1349–4754 [015].
V891	Cen =	73363	= V 1350–4802 [015].
V892	Cen =	73364	= HD 121276 (A0) [091] = CoD−51°7839 (9.6) = CPD−51°6430 (8.6) = SAO 241303 = GSC 8275.1886.
V893	Cen =	73366	= Star B [092] = IRAS 13568–6232. Not HD 121918.
V894	Cen =	73369	= IRAS 14122–5947 [093].
V895	Cen =	73372	= EUVE J1429–38.0 (candidate 2) [094] = Prager 3734 = HV 7408 = CSV 2143 = NSV 06680.
V896	Cen =	73376	= HD 128157 (F0) [067] = CoD−59°5334 (8.4) = CPD−59°5662 (8.2) = SAO 241852 = GSC 8691.3053.
V389	Cep =	73684	= No.3 [095] = NSV 13756.
V390	Cep =	73693	= LkHα 349 [096] = HBC 308 = NSV 13814 = GSC 3975.0396. In the cometary nebula IC 1396A.
V391	Cep =	73694	= No.7 [098] = GSC 4261.0743.
V392	Cep =	73696	= RNO 138S [099]. Illuminating star of the nebula RNO 138 in NGC 7129. Brightened at least by $1\overset{m}{.}2$ in [SII] (λ_0 = 6740Å, FWHM = 70Å) between 1988 and 1993.
V393	Cep =	73698	= No.6 [095] = NSV 13897.
V394	Cep =	73707	= No.8 [095] = NSV 14008 = GSC 3981.1498.
V395	Cep =	73748	= BD+73°1031 (9.5) = IRAS 23189+7357 = AS 507 [100] = HBC 741 = GSC 4490.0538.
BW	Cet =	73037	= HD 9289 (A3) [101] = BD−11°286 (9.0) = SAO 147854 = GSC 5274.0240.
BX	Cet =	73050	= Gliese 105B [018] = G 73-71 = LHS 16 = LFT 218 = LTT 10859 = GSC 0052.0151.
BY	Cet =	73053	= BD−0°431 (8.8) = SAO 130113 = EXOSAT 0244–0024 = EXO 024453–0024.9 [103] = GSC 4699.0241.
BZ	Cet =	73056	= HD 18632 (G5) = BD+7°459 (8.3) = SAO 110894 = 1E 0257.4+0733 = HIC 013976 [005] = GSC 0641.0305.

Table 2 (continued)

CC	Cet =	73059	= PG 0308+096 [104] = WD 0308+096 = GSC 0648.1198.
CD	Cet =	73060	= Gliese 1057 [018] = G 77-31 = LHS 168 = GSC 0059.0616.
DL	Cha =	73355	= S 6439 [105,106] = IRAS 13022–7650 = CSV 6983 = NSV 06083 = GSC 9417.0318.
BX	Cir =	73367	= LSS 3184 [107] = GSC 9017.1207.
BY	Cir =	73377	= Nova Cir 1995 [108, *Liller*].
BZ	Cir =	73379	= 1E 1449.8–6803 [110] = CIR 1.
CC	Cir =	73384	= HD 134877 (O) = WR 66 [112] = LSS 3322 = He 3-1058 = GSC 8706.0757.
UU	Col =	73146	= RX J0512.2–3241 [113].
UV	Col =	73150	= IRAS 05150–4056 [014] = HV 8043 = Prager 2732 = 706.1935 = CSV 535 = NSV 01911 = GSC 7591.0707.
UW	Col =	73153	= IRAS 05242–2852 [014].
UX	Col =	73155	= CoD$-33°$2353 (9.7) = CPD$-33°$819 (10.2) = EXOSAT 0527–3329 = EXO 052707–3329.2 [103] = GSC 7059.1111.
UY	Col =	73207	= HD 40765 (F2) [114] = CoD$-30°$2754 (8.6) = CPD$-30°$1091 (9.1) = SAO 196385 = GSC 7058.0210.
IQ	Com =	73291	= No.19 [003].
IR	Com =	73341	= S 10932 [115,355] = RX J1239.5+2108.
IS	Com =	73357	= No.22 [003] = GSC 1996.1193.
IT	Com =	73361	= HD 118234 (K0) = BD$+21°$2548 (7.8) = SAO 082886 = IRAS 13327+2102 = HIC 066286 [005] = GSC 1465.1022.
V703	CrA =	73495	= IRAS 17552–3909 [116]. Not V695 Sco.
V704	CrA =	73547	= HD 168947 (A2) [117] = CoD$-44°$12574 (8.4) = CPD$-44°$9121 (8.4) = SAO 228991 = GSC 7913.1173.
V705	CrA =	73558	= CV4 in Sgr control field [118].
V706	CrA =	73559	= CV1 in Sgr control field [118].
V707	CrA =	73560	= CV3 in Sgr control field [118].
V708	CrA =	73561	= CV2 in Sgr control field [118].
V709	CrA =	73572	= CoD$-37°$13022 (10) = HBC 676 [119] = VSS 47 = Wa CrA1 = Kn Anon1 = GlPe i2 = GSC 7421.1890.
V710	CrA =	73573	= HH 100 IRS [121,382] = Herbig–Haro object in CrA. IR source associated with the HH object.
UZ	CrB =	73385	= No.27 [003].
VV	CrB =	73391	= S 10934 [123] = IRAS 15489+3139 = GSC 2572.0355.
VW	CrB =	73397	= Var 21 [124].
VX	CrB =	73398	= Var 22 [124] = GSC 2576.0466 [125].
VY	CrB =	73400	= Var 23 [124] = GSC 2576.0980.
VZ	CrB =	73403	= Var 20 [124].
WW	CrB =	73404	= Var 6 [126] = GSC 3062.0876.
WX	CrB =	73406	= Var 7 [126] = GSC 3062.0052.
WY	CrB =	73407	= Var 19 [124].
WZ	CrB =	73408	= Var 16 [127].
XX	CrB =	73409	= No.28 [003] = GSC 2051.0528.
TW	Crv =	73290	= EC 11575–1845 [128] = GSC 6097.0879.
TV	Crt =	73285	= HD 98800 (K2) [005] = CoD$-24°$9706 (8.8) = CPD$-24°$4651 (9.1) = SAO 179815 = ADS 8141 = IRAS 11195–2430 = Gliese 2084AB = HIP 055505 = GSC 6654.0219.
CO	Cru =	73292	= HD 105513 (F0) [129] = CoD$-55°$4437 (9.4) = CPD$-55°$4874 (8.8) = SAO 239697 = GSC 8636.2502.
CP	Cru =	73293	= Probable Nova Cru 1996 [130].
CQ	Cru =	73343	= No.74 [131] = I-20 (NGC 4755) = GSC 8989.2533.
CR	Cru =	73344	= No.83 [131] = I-07 (NGC 4755) = GSC 8989.2338.
CS	Cru =	73345	= CPD$-59°$4546 (9.4) = No.16 [131] = IV-17 (NGC 4755) = 417 (NGC 4755) [356] = He 3-833 = Wray 15-1030 = GSC 8989.2082.
CT	Cru =	73346	= CPD$-59°$4549 (10.1) = No.63 [131] = III-01 (NGC 4755) = LSS 2810 = GSC 8989.2014.
CU	Cru =	73347	= No.73 [131] = II-04 (NGC 4755).
CV	Cru =	73348	= CPD$-59°$4550 (9.5) = No.141 [131] = I (NGC 4755) = GSC 8989.2418.

Table 2 (continued)

CW	Cru =	73349	= CPD−59°4559 (10.1) = No.29 [131] = III-06 (NGC 4755) = 306 (NGC 4755) [356] = He 3-834 = GSC 8989.1678.
CX	Cru =	73350	= CPD−59°4558 (10) = No.75 [131] = II-02 (NGC 4755) = GSC 8989.1871.
CY	Cru =	73351	= CPD−59°4560 (9.7) = No.61 [131] = III-07 (NGC 4755) = LSS 2814 = HIP 062937 = GSC 8989.3111?
CZ	Cru =	73352	= CPD−59°4562 (9.6) = No.87 [131] = II-10 (NGC 4755) = LSS 2815 = GSC 8989.2022.
V2028	Cyg =	73613	= MWC 623 [133] = He 3-1805 = LS II+30°8 = IRAS 19545+3058 = GSC 2669.4333.
V2029	Cyg =	73624	= CCS 2899 [134] = IRAS 20213+4727 = GSC 3576.2151.
V2030	Cyg =	73625	= BC 42 [134].
V2031	Cyg =	73626	= HD 194378 (F) [135] = BD+38°4063 (8.9) = SAO 069957 = Hoag 1 (NGC 6913) = Sanders 135 = Zug 2 [357] = Tifft 10 = HIP 100586 = GSC 3152.0040.
V2032	Cyg =	73628	= CCS 2908 [134] = IRAS 20292+4611 = GSC 3573.2409.
V2033	Cyg =	73629	= CCS 2909 [134] = GSC 3573.1485.
V2034	Cyg =	73630	= CCS 2911 [134] = IRAS 20321+4909 = GSC 3581.1545.
V2035	Cyg =	73631	= CCS 2914 [134] = IRAS 20337+4518 = GSC 3573.0420.
V2036	Cyg =	73632	= BC 43 [134] = IRAS 20359+4946.
V2037	Cyg =	73634	= CCS 2920 [134] = IRAS 20360+4845 = GSC 3582.1630.
V2038	Cyg =	73635	= BC 239 [134] = GSC 3582.0707.
V2039	Cyg =	73637	= CCS 2927 [134] = IRAS 20431+4652 = GSC 3578.0357.
V2040	Cyg =	73638	= CCS 2930 [134] = GSC 3178.0517.
V2041	Cyg =	73640	= Ton 8 in Cyg T1 [136].
V2042	Cyg =	73641	= CCS 2936 [134] = IRAS 20476+4637 = GSC 3575.5461.
V2043	Cyg =	73643	= B 42 in the NGC 7000 region [137,138].
V2044	Cyg =	73645	= LD 32 [139] = GSC 3575.4390.
V2045	Cyg =	73646	= CCS 2939 [134].
V2046	Cyg =	73647	= CCS 2941 [134] = IRAS 20514+5331 = SVS 2404.
V2047	Cyg =	73648	= Ton 9 in Cyg T1 [136].
V2048	Cyg =	73649	= Ton 10 in Cyg T1 [136].
V2049	Cyg =	73651	= Ton 11 in Cyg T1 [136].
V2050	Cyg =	73652	= Anon Cyg [140] = GSC 3171.0197.
V2051	Cyg =	73653	= Ton 12 in Cyg T1 [136].
V2052	Cyg =	73655	= Ton 13 in Cyg T1 [136].
V2053	Cyg =	73656	= CCS 2961 [134] = GSC 3588.7852.
V2054	Cyg =	73657	= CCS 2964 [134] = CSV 8611 = NSV 13496.
V2055	Cyg =	73658	= BC 74 [134] = IRAS 21017+5402.
V2056	Cyg =	73659	= CCS 2967 [134].
V2057	Cyg =	73661	= Ton 14 in Cyg T1 [136].
V2058	Cyg =	73663	= CCS 2986 [134] = GSC 3180.2398.
V2059	Cyg =	73664	= CCS 2987 [134] = GSC 3588.8299.
V2060	Cyg =	73666	= BC 75 [134] = IRAS 21082+5358 = SVS 2407 = GSC 3953.1310.
V2061	Cyg =	73667	= CCS 2996 [134].
V2062	Cyg =	73668	= New variable star in Cepheus region [141] = GSC 3953.1078.
V2063	Cyg =	73669	= CCS 3000 [134].
V2064	Cyg =	73670	= CCS 3001 [134] = IRAS 21115+5406 = SVS 2408 = GSC 3953.0793.
V2065	Cyg =	73671	= BC 46 [134] = GSC 3177.2636.
V2066	Cyg =	73672	= CCS 3007 [134] = GSC 3177.1965.
V2067	Cyg =	73673	= CCS 3011 [134] = IRAS 21151+5010 = SVS 2409.
V2068	Cyg =	73677	= BC 76 [134] = IRAS 21196+5453 = SVS 2411 = GSC 3970.1259.
V2069	Cyg =	73678	= RX J2123.7+4217 [068].
V2070	Cyg =	73680	= CCS 3033 [134] = IRAS 21250+5206 = SVS 2412.
V2071	Cyg =	73686	= CCS 3037 [134] = IRAS 21288+4938 = SVS 2413 = GSC 3598.1178.
V2072	Cyg =	73687	= LD 55 [139] = V 11 [143] = IRAS 21292+3833.
V2073	Cyg =	73690	= CCS 3039 [134] = IRAS 21301+5255 = GSC 3966.1256.
V2074	Cyg =	73695	= CCS 3065 [134] = LD 65 [139] = IRAS 21417+4855 = SVS 2415 = GSC 3599.2290.
V2075	Cyg =	73700	= HD 208472 (K0) = BD+43°4087 (7.0) = SAO 051437 = IRAS 21532+4410 = HIC 108198 [005] = GSC 3197.1790.

Table 2 (continued)

V2076	Cyg =	73701	= LD 187 [011].
LW	Del =	73633	= Prager 5435 = SVS 651 = CSV 5237 = NSV 13191 [144] = GSC 1088.0993.
LX	Del =	73644	= HV 10648 = CSV 5292 = NSV 13368 [145] = GSC 0524.0645.
LY	Del =	73660	= TAV 2106+194 [146] = GSC 1657.1754.
EU	Dra =	73382	= HD 135262 (G0) [147] = BD+64°1050 (8.0) = SAO 016628 = HIP 074280 = GSC 4183.0211.
EV	Dra =	73399	= HD 144110 (G5) = BD+51°2051 (8.3) = SAO 029761 = RE 1601+512 = HIC 078519 [005] = GSC 3497.0736.
EW	Dra =	73405	= Gliese 617B [018] = G 225-58 = LHS 3176 = GSC 4195.1167. Gliese 617A = NSV 07624.
EX	Dra =	73514	= HS 1804+6753 [149,*Barwig et al.*] = C-object [150] = KUV 18044+6754 = MS 1804.3+6753 = GSC 4429.1070 [151].
EY	Dra =	73543	= RE 1816+541 [152] = EUVE J1816+541 = GSC 3904.0967.
EZ	Dra =	73619	= Prager 5342 = 32.1934 = IRAS 20096+6648 = CSV 5080 = NSV 12872 [154] = GSC 4244.0152.
ER	Eri =	73044	= CoD−55°479 (9.9) = CPD−55°398 (9.6) = He 3-1 = PDS 1 [155] = GSC 8483.1210.
ES	Eri =	73065	= 1E 0315.7–1955 [156] = GSC 5875.0847.
ET	Eri =	73080	= IRAS 03287–1535 [033] = Stephenson 24 = GSC 5873.0263.
EU	Eri =	73093	= HD 23548 (K5) = CoD−42°1226 (7.3) = CPD−42°356 (8.2) = SAO 216463 = IRAS 03425–4203 = HIP 017447 = GSC 7572.1544 [157].
EV	Eri =	73105	= IRAS 04067–0922 [033] = GSC 5312.2096.
EW	Eri =	73133	= L 1642-1A [158] = HBC 413 = IRAS 04327–1419 = GSC 5320.1227.
EX	Eri =	73140	= HR 1525 = HD 30422 (A2) [160] = CoD−28°1735 (6.4) = CPD−28°649 (6.8) = SAO 169752 = GSC 6471.0474.
EY	Eri =	73141	= IRAS 04505–1006 [014].
EZ	Eri =	73145	= BD−5°1159 (9.5) = 1E 0505.0–0527 [156] = GSC 4758.1316.
VW	For =	73054	= V 0252–3037 [015].
VX	For =	73076	= Probable Dwarf Nova in Fornax [161] = Suspected var. near TU For.
VY	For =	73083	= EXOSAT 0329–2606 = EXO 032957–2606.9 [162] = FOR 1.
PR	Gem =	73219	= No.9 [003].
PS	Gem =	73224	= HD 52961 (A0) = BD+10°1392 (8.6) = SAO 096430 [358] = HIP 034038 = GSC 0753.1411.
PT	Gem =	73234	= No.10 [003].
CH	Gru =	73681	= V5 [166].
CI	Gru =	73689	= V6 [166] = GRU 1.
CK	Gru =	73751	= Prager 5749 = 618.1935 = HV 9758 = IRAS 23213–4521 = AFGL 4296 = CSV 5712 = NSV 14540 [014] = GSC 8455.1039.
V842	Her =	73401	= BD+50°2255 (9.3) = BV 103 = CSV 7268 = NSV 07457 [167] = GSC 3497.0263.
V843	Her =	73410	= Var 51 [168] = GSC 3065.1355.
V844	Her =	73413	= Var 43 [168].
V845	Her =	73414	= Var 4 [126] = GSC 3065.0704.
V846	Her =	73419	= HD 148405 (K0) [005] = BD+24°3008 (8.8) = SAO 084381 = GSC 2043.0407.
V847	Her =	73422	= Var 3 [126] = GSC 3066.0251.
V848	Her =	73424	= Var 15 [127] = GSC 2584.0550.
V849	Her =	73426	= PG 1633+115 [169] = HER 2.
V850	Her =	73427	= Var 5 [126].
V851	Her =	73428	= Var 2 [126].
V852	Her =	73430	= Var 24 [124] = GSC 2053.0776.
V853	Her =	73431	= Var 46 [168].
V854	Her =	73432	= Var 11 [127] = GSC 2585.2215.
V855	Her =	73433	= Var 17 [127].
V856	Her =	73435	= Var 18 [127] = GSC 3074.0305.
V857	Her =	73436	= BV 105 [042] = CSV 7493 = NSV 07968 = GSC 3070.0345.
V858	Her =	73437	= Var 12 [127].
V859	Her =	73438	= Var 1 [126].
V860	Her =	73439	= No.29 [003].

Table 2 (continued)

V861	Her =	73440	= Var 44 [168] = GSC 3079.0201.
V862	Her =	73444	= Var 45 [168] = GSC 3075.0885.
V863	Her =	73445	= Var 49 [168] = GSC 3079.0460.
V864	Her =	73446	= No.30 [003] = GSC 2067.0530.
V865	Her =	73447	= Var 10 [126] = GSC 3079.0534.
V866	Her =	73448	= Var 9 [126] = IRAS 16582+4115 = GSC 3075.0202.
V867	Her =	73449	= Var 48 [168].
V868	Her =	73450	= Var 14 [127].
V869	Her =	73452	= Var 47 [168] = GSC 3072.0441.
V870	Her =	73453	= Var 8 [126].
V871	Her =	73454	= Var 13 [127].
V872	Her =	73455	= Var 50 [168] = GSC 3076.0951.
V873	Her =	73456	= HD 155118 (F0) = BD+16°3105 (8.0) = SAO 102617 = HIC 083921 [171] = GSC 1535.1319.
V874	Her =	73457	= BD+49°2601 (9.2) = SAO 046557 = Prager 1219 = 4.1932 = CSV 3038 = NSV 08316 [172] = GSC 3504.0057.
V875	Her =	73459	= No.32 [003].
V876	Her =	73461	= No.34 [003].
V877	Her =	73462	= No.35 [003] = GSC 2082.0709.
V878	Her =	73464	= BD+49°2630 (8.5) = SAO 046698 = DHK 40 [174] = GSC 3516.0047.
V879	Her =	73467	= No.36 [003].
V880	Her =	73472	= No.37 [003].
V881	Her =	73473	= No.38 [003].
V882	Her =	73476	= No.39 [003].
V883	Her =	73491	= No.40 [003] = GSC 2085.0526.
V884	Her =	73506	= WGA J1802.1+1804 [175].
V885	Her =	73513	= ADS 11060C [176] = BD+21°3302C (AC: 28″.37, 171°.7, 1905; AB = V772 Her).
V886	Her =	73519	= HD 341617 (A5) [177] = BD+24°3337 (8.8) = SAO 085766 = IRAS 18062+2410 = GSC 2091.0591.
V887	Her =	73536	= IRAS 18095+2704 [022,359] = GSC 2100.0044.
V888	Her =	73537	= No.41 [003].
V889	Her =	73562	= HD 171488 (G0) = BD+18°3734 (7.0) = SAO 103862 = RE 1834+184 = HIC 091043 [005] = GSC 1574.0517.
MM	Hya =	73254	= PG 0911–066 [169] = HYA 1 = GSC 4891.0637.
MN	Hya =	73258	= RX J0929.1–2404 [178].
MO	Hya =	73342	= HR 4881 = HD 111786 (A0) [179] = CoD−26°9369 (6.3) = CPD−26°4812 (6.4) = SAO 181169 = GSC 6705.1317.
MP	Hya =	73373	= HD 127269 (A2) [180] = CoD−24°11533 (7.6) = CPD−24°5332 (7.4) = SAO 182624 = GSC 6749.1660.
BI	Ind =	73744	= HD 219025 (K0) [181] = CoD−68°2333 (8.0) = CPD−68°3563 (8.4) = GSC 9338.2053.
V378	Lac =	73708	= HD 209596 (Na) = S 8577 = CCS 101 [134] = IRAS 22014+4519 = NSV 14010 = HIP 108892 = GSC 3605.0545.
V379	Lac =	73710	= LD 190 [011] = IRAS 22057+4050.
V380	Lac =	73711	= LD 194 [011] = IRAS 22081+3801.
V381	Lac =	73714	= LD 197 [011] = IRAS 22138+4207.
V382	Lac =	73715	= LD 198 [011] = IRAS 22175+4757.
V383	Lac =	73716	= BD+48°3686 (8.5) [005] = SAO 051891 = RE 2220+493 [182] = EUVE J2220+49.5 = GSC 3615.1729.
V384	Lac =	73718	= LD 199 [011] = S 8583 [368] = NSV 14144.
V385	Lac =	73720	= LD 201 [011] = IRAS 22236+5002.
V386	Lac =	73722	= LD 204 [011].
V387	Lac =	73724	= LD 205 [011] = IRAS 22294+4800 = GSC 3624.1959.
V388	Lac =	73727	= LD 206 [011].
V389	Lac =	73729	= LD 207 [011] = IRAS 22410+4101 = GSC 3222.0149.
V390	Lac =	73730	= LD 208 [011] = IRAS 22431+5036.
V391	Lac =	73732	= LD 210 [011] = IRAS 22474+5202 = GSC 3633.2259.
V392	Lac =	73733	= LD 211 [011] = IRAS 22481+5308.

Table 2 (continued)

DX	Leo =	73259	= HD 82443 (K0) = BD+27°1775 (7.0) = SAO 080897 = IRAS 09298+2712 = Gliese 354.1A = HIC 046843 [005] = GSC 1962.0469.
DY	Leo =	73265	= HD 85091 (F8) = BD+11°2108 (7.8) = SAO 098794 = HIC 048215 [005] = GSC 0831.1479.
DZ	Leo =	73267	= No.13 [003].
EE	Leo =	73278	= Gliese 402 [018,361] = G 44-40 = LHS 294 = LFT 742 = Wolf 358 = GSC 0261.0224.
EF	Leo =	73288	= No.17 [003].
SY	LMi =	73271	= No.14 [003].
SZ	LMi =	73275	= No.15 [003].
TT	LMi =	73279	= No.16 [003].
HN	Lib =	73375	= BD−11°3759 (10) = Gliese 555 [018] = LHS 2945 = LTT 5759 = NSV 06707 = GSC 5572.0804.
HO	Lib =	73387	= BD−7°4003 (9.8) = Gliese 581 [018] = G 151-46 = LHS 394 = LTT 6112 = Wolf 562 = NSV 07023 = GSC 5594.0593.
HP	Lib =	73388	= EC 15330–1403 [183] = GSC 5608.1089.
HQ	Lib =	73390	= BD−17°4392 (9.8) = EC 15360–1734 [184] = GSC 6189.0952.
HR	Lib =	73394	= HR 5930 = HD 142703 (A0) [185] = BD−14°4314 (6.7) = SAO 159587 = GSC 5622.1574.
λ	Lib =	73392	= lambda Lib [186] = 45 Lib = HR 5902 = HD 142096 (B3) = BD−19°4249 (5.4) = CPD−19°5920 (5.0) = SAO 183895 = IRAS 15504–2001 = GSC 6195.1763.
IN	Lup =	73395	= HD 142994 (F0) [185,362] = CoD−38°10783 (7.3) = CPD−38°6314 (7.0) = SAO 207192 = GSC 7838.0433.
IO	Lup =	73396	= HD 143232 (F0) [187] = CoD−38°10803 (7.1) = CPD−38°6325 (7.1) = SAO 207224 = GSC 7851.1816.
BL	Lyn =	73228	= Gliese 277B [018] = G 87-43 = LTT 12035 = Ross 989B = NSV 03622 = GSC 2465.1600. Gliese 277A = VV Lyn.
BM	Lyn =	73229	= HD 62668 (K0) = BD+47°1484 (7.3) = SAO 041995 = IRAS 07436+4727 = S 4742 = CSV 1125 = NSV 03726 = HIC 038003 [005] = GSC 3407.0482.
BN	Lyn =	73237	= 31 Lyn = HR 3275 [039] = HD 70272 (K5) = BD+43°1815 (5.0) = SAO 042319 = IRC+40195 = IRAS 08194+4320 = NSV 04030 = GSC 2980.2184.
BO	Lyn =	73243	= No.63 in the RR7 field [188] = GSC 2985.1044.
BP	Lyn =	73252	= PG 0859+415 = KUV 08599+4130 [189] = LYN 1 = GSC 2986.1825.
V505	Lyr =	73563	= No.43 [003].
V506	Lyr =	73564	= No.44 [003].
V507	Lyr =	73566	= No.45 [003] = GSC 2115.0522.
V508	Lyr =	73567	= No.46 [003].
V509	Lyr =	73569	= No.47 [003].
V510	Lyr =	73570	= No.48 [003].
V511	Lyr =	73577	= HD 337518 (K0) = BD+27°3245 (9.0) = SAO 086811 = RE 1906+274 = G 207-15 = HIC 093817 [005] = GSC 2130.2347.
V512	Lyr =	73578	= S 10931 [190].
V513	Lyr =	73584	= V7 (NGC 6791) [191].
V514	Lyr =	73585	= V8 (NGC 6791) [191].
V515	Lyr =	73586	= V11 (NGC 6791) [191].
V516	Lyr =	73587	= B8 (NGC 6791) [193].
V517	Lyr =	73588	= V12 (NGC 6791) [191].
V518	Lyr =	73589	= V5 (NGC 6791) [191].
V519	Lyr =	73590	= V1 (NGC 6791) [191].
V520	Lyr =	73591	= V9 (NGC 6791) [191].
V521	Lyr =	73592	= V4 (NGC 6791) [191].
V522	Lyr =	73593	= V6 (NGC 6791) [191].
V523	Lyr =	73596	= V15 (NGC 6791) [191] = B7.
V524	Lyr =	73597	= V10 (NGC 6791) [191].
V525	Lyr =	73598	= V3 (NGC 6791) [191].
V526	Lyr =	73599	= V2 (NGC 6791) [191].
AH	Men =	73214	= 1H 0551–819 [194] = 1H 0616–818 = MEN 1 = GSC 9391.0179.

Table 2 (continued)

BO	Mic =	73639	= HD 197890 (K0) [196] = CoD$-37°$13926 (8.6) = CPD$-37°$8883 (8.8) = SAO 212437 = 2RE J204746–363543 = HIP 102626 = “Speedy Mic” [196] = GSC 7469.0997.
BP	Mic =	73654	= IRAS 20571–3706 [014].
BQ	Mic =	73665	= IRAS 21069–3843 [014] = AFGL 5592.
BR	Mic =	73679	= HD 204076 (B5) [197,363] = CoD$-32°$16569 (8.5) = CPD$-32°$6371 (7.9) = SAO 213008 = GSC 7478.0765.
V713	Mon =	73216	= IRAS 06230–0930 = AFGL 935 [198].
V714	Mon =	73217	= S 3990 = CSV 761 = NSV 02980 = GSC 0141.0638.
V715	Mon =	73218	= HR 2517 [201] = HD 49567 (B3) [364] = BD$+1°$1531 (7.0) = SAO 114465 = HIP 032682 = GSC 0148.2853.
V716	Mon =	73233	= S 4082 = CSV 1162 = NSV 03775 = GSC 5415.0892.
GV	Mus =	73295	= V36 (Cr 261 field) [203].
GW	Mus =	73296	= V41 (Cr 261 field) [203].
GX	Mus =	73297	= V4 (Cr 261) [203].
GY	Mus =	73298	= V2 (Cr 261) [203].
GZ	Mus =	73299	= V30 (Cr 261) [203].
HH	Mus =	73300	= V20 (Cr 261 field) [203].
HI	Mus =	73301	= V8 (Cr 261 field) [203].
HK	Mus =	73302	= V10 (Cr 261 field) [203].
HL	Mus =	73303	= V26 (Cr 261) [203].
HM	Mus =	73304	= V19 (Cr 261) [203].
HN	Mus =	73305	= V22 (Cr 261) [203].
HO	Mus =	73306	= V17 (Cr 261) [203].
HP	Mus =	73307	= V23 (Cr 261 field) [203].
HQ	Mus =	73308	= V16 (Cr 261) [203].
HR	Mus =	73309	= V29 (Cr 261) [203].
HS	Mus =	73310	= V7 (Cr 261 field) [203].
HT	Mus =	73311	= V11 (Cr 261 field) [203].
HU	Mus =	73312	= V32 (Cr 261) [203].
HV	Mus =	73313	= V31 (Cr 261) [203].
HW	Mus =	73314	= V21 (Cr 261 field) [203].
HX	Mus =	73315	= V35 (Cr 261 field) [203].
HY	Mus =	73316	= V9 (Cr 261 field) [203].
HZ	Mus =	73317	= V37 (Cr 261) [203].
II	Mus =	73318	= V28 (Cr 261) [203].
IK	Mus =	73319	= V13 (Cr 261) [203].
IL	Mus =	73320	= V33 (Cr 261) [203].
IM	Mus =	73321	= V38 (Cr 261 field) [203].
IN	Mus =	73322	= V44 (Cr 261 field) [203].
IO	Mus =	73323	= V25 (Cr 261) [203].
IP	Mus =	73324	= V45 (Cr 261) [203].
IQ	Mus =	73325	= V12 (Cr 261) [203] = S 8990 = NSV 05795.
IR	Mus =	73326	= V15 (Cr 261) [203].
IS	Mus =	73327	= V18 (Cr 261 field) [203].
IT	Mus =	73328	= V34 (Cr 261 field) [203].
IU	Mus =	73329	= V14 (Cr 261 field) [203].
IV	Mus =	73331	= V6 (Cr 261 field) [203].
IW	Mus =	73332	= V24 (Cr 261) [203].
IX	Mus =	73333	= V1 (Cr 261 field) [203].
IY	Mus =	73334	= V40 (Cr 261) [203].
IZ	Mus =	73335	= V3 (Cr 261 field) [203].
KK	Mus =	73336	= V42 (Cr 261 field) [203].
KL	Mus =	73337	= V43 (Cr 261) [203].
KM	Mus =	73339	= V39 (Cr 261) [203].
KN	Mus =	73360	= PNN of NGC 5189 [047] = HD 117622 (Neb.) = PK 307 $-$ 3°1 = He 2-94 = IRAS 13300–6543 = NSV 06296 = GSC 9003.0669.
V354	Nor =	73389	= CoD$-48°$10153 (10) [205] = CPD$-48°$7730 (9.7) = GSC 8300.3214.
V355	Nor =	73415	= IFA star 159 (NGC 6134) [206] = #29 [207] = GSC 8320.2133.

Table 2 (continued)

V356	Nor =	73416	= IFA star 9 (NGC 6134) [206] = #5 [207] = GSC 8320.1769.
V357	Nor =	73417	= IFA star 161 (NGC 6134) [206] = #40 [207] = GSC 8320.1923.
CL	Oct =	73079	= RE J0317–853 [208] = GSC 9495.2075.
CM	Oct =	73623	= IRAS 20168–7849 [014].
V2304	Oph =	73411	= Ton 5 in the ρ Oph region [209].
V2305	Oph =	73412	= Ton 6 in the ρ Oph region [209].
V2306	Oph =	73423	= BD$-12°$4523 (9.5) = Gliese 628 [018] = G 153-58 = LHS 419 = LTT 6580 = NSV 07768 = GSC 5635.0564 = GSC 5635.1232.
V2307	Oph =	73434	= HD 150193 (A0) [211,365] = CoD$-23°$12887 (8.7) = CPD$-23°$6381 (8.1) = SAO 184536 = IRAS 16372–2347 = MWC 863 = GSC 6796.1287.
V2308	Oph =	73451	= IRAS 17002–2830 [116].
V2309	Oph =	73463	= CoD$-29°$13477 (9.0) = IRC–30293 = AFGL 1961 = IRAS 17208–2916 = CCS 2438 = No.1337 [212] = GSC 6837.0013.
V2310	Oph =	73465	= CoD$-23°$13397 (9.9) = PNN of NGC 6369 [047] = PK $2+5°1$ = IRAS 17262–2343.
V2311	Oph =	73466	= IRC–30300 = AFGL 1972 = IRAS 17269–2625 = No.2319 [213] = NSV 08891.
V2312	Oph =	73468	= HV 10972 = CSV 3258 = NSV 09136 = GSC 0996.0190.
V2313	Oph =	73470	= Nova Oph 1994 [215, *Akihiko Tago*].
V2314	Oph =	73474	= HD 161223 (A2) [217] = BD+6°3514 (8.0) = SAO 122683 = Kopff 28 (IC 4665) [366] = GSC 0427.1650.
V2315	Oph =	73475	= HD 161261 (B9) [218,367] = BD+5°3471 (8.2) = SAO122687 = Kopff 32 (IC 4665) = GSC 0427.1623.
V2316	Oph =	73477	= P 71 (IC 4665) [219] = S 39 (IC 4665) = GSC 0428.1470.
V2317	Oph =	73478	= P 12 (IC 4665) [219] = GSC 0424.0759.
V2318	Oph =	73479	= P 75 (IC 4665) [219] = S 50 (IC 4665).
V2319	Oph =	73480	= P 27 (IC 4665) [219] = V No.81 (IC 4665) = GSC 0424.0100.
V2320	Oph =	73481	= HD 161603 (B9) [218] = BD+5°3484 (7.7) = SAO 122725 = Kopff 64 (IC 4665) = GSC 0428.1685.
V2321	Oph =	73482	= P 100 (IC 4665) [219].
V2322	Oph =	73483	= P 39 (IC 4665) [219] = V No.109 (IC 4665) = GSC 0428.0294.
V2323	Oph =	73484	= HD 161660 (B9) [218] = BD+6°3525 (7.9) = SAO 122734 = Kopff 72 (IC 4665) = GSC 0428.0215.
V2324	Oph =	73485	= HD 161698 (B9) [218] = BD+5°3491 (8.3) = SAO 122738 = ADS 10783 = Kopff 76 (IC 4665) = GSC 0424.0055.
V2325	Oph =	73486	= P 150 (IC 4665) [219] = V No.175 (IC 4665) = GSC 0424.0980.
V2326	Oph =	73487	= P 155 (IC 4665) [219] = S 247 (IC 4665) = GSC 0424.1220.
V2327	Oph =	73488	= HD 162028 (B9) [218] = BD+5°3504 (8.2) = SAO 122776 = Kopff 105 (IC 4665) = GSC 0428.1300.
V2328	Oph =	73489	= Var 29 [223].
V2329	Oph =	73493	= Var 34 [224].
V2330	Oph =	73500	= Var 35 [224].
V2331	Oph =	73503	= Var 36 [224].
V2332	Oph =	73504	= Var 37 [224] = GSC 1008.1752.
V2333	Oph =	73505	= Var 31 [223] = GSC 1008.0492.
V2334	Oph =	73507	= Var 28 [223].
V2335	Oph =	73508	= Var 25 [223].
V2336	Oph =	73509	= Var 32 [223].
V2337	Oph =	73510	= Var 33 [223] = GSC 1008.1491.
V2338	Oph =	73511	= S 9291 = NSV 10183 [225] = GSC 1008.1699.
V2339	Oph =	73512	= Var 38 [224] = IRAS 18033+0727 = GSC 0442.0118.
V2340	Oph =	73515	= Var 30 [223] = IRAS 18047+0822 = GSC 1008.1326.
V2341	Oph =	73516	= Var 39 [224] = IRAS 18047+0719 = GSC 0442.0113.
V2342	Oph =	73538	= Var 26 [223] = IRAS 18101+0835 = GSC 1009.1098.
V2343	Oph =	73539	= Var 42 [224] = IRAS 18103+0751?
V2344	Oph =	73540	= Var 27 [223] = IRAS 18110+0851 = GSC 1009.0361.
V2345	Oph =	73541	= Var 40 [224].
V2346	Oph =	73544	= Var 41 [224] = GSC 1010.2541.
V2347	Oph =	73550	= IRAS 18254+0750 [029].

Table 2 (continued)

V1309	Ori =	73148	= RJ 051542+0104.7 [369] = RX J0515.6+0105 [226] = RX J051541+0104.6 [227].
V1310	Ori =	73154	= T 326 [228] = Tof 326.
V1311	Ori =	73156	= San 1 [229] = HRC 97 = TSN 20 = 2RE J053205–030509 = NSV 02096 = GSC 4770.0797.
V1312	Ori =	73158	= Ton 267 [231] = Π 999 = GSC 4774.0101.
V1313	Ori =	73159	= JW 65[233].
V1314	Ori =	73160	= JW 101 [233].
V1315	Ori =	73161	= JW 167 [233].
V1316	Ori =	73162	= JW 174 [233].
V1317	Ori =	73163	= JW 179 [233].
V1318	Ori =	73164	= JW 191 [234].
V1319	Ori =	73165	= JW 220 [233] = Π 1704.
V1320	Ori =	73166	= JW 222 [233].
V1321	Ori =	73167	= JW 238 = Π 1724 [370] = HBC 452 = EXOSAT 0532–0510 = EXO 053237–0510.1 [103] = GSC 4774.0910.
V1322	Ori =	73168	= JW 245 [233].
V1323	Ori =	73169	= JW 254 [233].
V1324	Ori =	73170	= JW 275 [233] = Π 1745.
V1325	Ori =	73171	= JW 326 [233].
V1326	Ori =	73172	= JW 337 [233] = Π 1771 = Zinner 421 = CSV 100570 = NSV 02276.
V1327	Ori =	73173	= JW 406 [233].
V1328	Ori =	73174	= JW 437 [233] = Π 1826.
V1329	Ori =	73175	= JW 439 [233].
V1330	Ori =	73176	= JW 454 [233] = Π 1840 = CSV 100578 = NSV 02287.
V1331	Ori =	73177	= JW 470 [234].
V1332	Ori =	73178	= JW 481 [233].
V1333	Ori =	73179	= JW 536 [233] = Π 1887.
V1334	Ori =	73180	= JW 560 [233].
V1335	Ori =	73181	= JW 563 [233].
V1336	Ori =	73182	= JW 588 [234].
V1337	Ori =	73183	= JW 607 [233].
V1338	Ori =	73184	= JW 641 [233] = Π 1962 = CSV 100592 = NSV 02311.
V1339	Ori =	73185	= JW 674 [233] = E 23 [236] = CSV 6266 = NSV 02315.
V1340	Ori =	73186	= JW 716 [233].
V1341	Ori =	73187	= JW 717 [233].
V1342	Ori =	73188	= JW 737 [233].
V1343	Ori =	73189	= JW 771NW [233]. ($16\overset{m}{.}2$Ic.
V1344	Ori =	73190	= JW 765 [233] = Π 2005.
V1345	Ori =	73191	= JW 811 [234].
V1346	Ori =	73192	= JW 842NW [233]. ($16\overset{m}{.}2$Ic.
V1347	Ori =	73193	= JW 819 [233].
V1348	Ori =	73194	= JW 850 [234] = Π 2077.
V1349	Ori =	73195	= JW 876N [233]. ($16\overset{m}{.}2$Ic. Coordinates need confirmation.
V1350	Ori =	73196	= JW 930 [233].
V1351	Ori =	73197	= JW 984 [233] = E 38 [236] = CSV 6296 = NSV 02370.
V1352	Ori =	73200	= Gliese 213 [018,361] = G 102-22 = LHS 31 = Ross 47 = GSC 0722.0455.
V1353	Ori =	73201	= GSC 4767.0894 [238].
V1354	Ori =	73202	= No.481 [229] = GSC 4775.0051.
V1355	Ori =	73208	= HD 291095 (K0) [055] = BD$-0°$1147 (9.1) = 2RE J060240–005153 = GSC 4782.1322.
V1356	Ori =	73209	= Star 12 (NGC 2169) [371] = GSC 0742.2169.
V1357	Ori =	73211	= HR 2208 [242,380] = HD 42807 (G5) = BD$+10°$1050 (6.5) = SAO 095394 = IRAS 06104+1038 = Gliese 230 = GSC 0734.2214.
V1358	Ori =	73213	= HD 43989 (G0) [055] = BD$-3°$1386 (8.5) = SAO 133095 = 2RE J061909-032541 = HIP 030030 = GSC 4788.1272.
χ^1	Ori =	73203	= khi1 Ori = HR 2047 [242] = HD 39587 (F8) = BD$+20°$1162 (5.0) = SAO 077705 = IRC+20126 = IRAS 05514+2016 = Gliese 222AB = GSC 1320.2118.

Table 2 (continued)

V346	Pav =	73546	= HR 6871 = HD 168740 (A2) [243] = CoD−63°1353 (6.5) = CPD−63°4406 (6.6) = SAO 254237 = GSC 9072.2407.
V347	Pav =	73565	= RE J1844–741 = RE 1844–74 [245] = 2RE J184450–741853.
V348	Pav =	73612	= V 1956–6034 [015].
V349	Pav =	73614	= V 2008–6527 = V 2009–65.5 = Drissen V211b [247].
V350	Pav =	73620	= S 7053 [106] = IRAS 20135–7152 = CSV 8457 = NSV 12961.
V351	Pav =	73642	= IRAS 20484–7202 [014].
LN	Peg =	73005	= BD+13°13 (8.7) = SAO 091772 (G5) [372] = 1E 0009.9+1417 = HIC 000999 = GSC 0601.0221.
LO	Peg =	73685	= BD+22°4409 (9.1) [248] = G 145-43 = RE 2131+23 = EUVE 2131+233 = HIP 106231 = GSC 2188.1136.
LP	Peg =	73691	= No.52 [003].
LQ	Peg =	73692	= PG 2133+115 [249] = PEG 6 = GSC 1128.0538.
LR	Peg =	73697	= No.53 [003].
LS	Peg =	73699	= Prager 5642 = 181.1935 = Stephenson Hα 193 [250] = PEG 2 = CSV 5478 = NSV13903 = GSC 1134.0745.
LT	Peg =	73702	= No.54 [003].
LU	Peg =	73703	= No.55 [003].
LV	Peg =	73704	= IRAS 21589+0821 [014] = GSC 1135.0762.
LW	Peg =	73705	= No.56 [003].
LX	Peg =	73706	= No.57 [003] = GSC 2212.2323.
LY	Peg =	73709	= WT 343 = GSC 1144.1023 [251].
LZ	Peg =	73712	= No.58 [003].
MM	Peg =	73717	= No.59 [003].
MN	Peg =	73723	= J 223114+0622 [252, *Takamizawa*] = GSC 0573.0974.
MO	Peg =	73726	= No.60 [003].
MP	Peg =	73728	= IRAS 22402+1045 [014] = GSC 1155.1692.
MQ	Peg =	73731	= No.61 [003] = GSC 2229.0149.
MR	Peg =	73735	= IRAS 22517+2223 [014] = GSC 2234.1146.
MS	Peg =	73736	= GD 245 [253] = EG 232 = WD 2256+249 = KUV 2256+249 = GSC 2238.0737.
MT	Peg =	73740	= HD 217813 (G0) [255] = BD+20°5264 (6.6) = SAO 090973 = GSC 1717.0687.
MU	Peg =	73741	= No.62 [003].
MV	Peg =	73742	= IRAS 23051+2330 [014].
MW	Peg =	73743	= BD+33°4659 (9.5) = DHK 43 [256] = GSC 2759.1984.
MX	Peg =	73749	= No.63 [003].
MY	Peg =	73753	= No.64 [003].
MZ	Peg =	73759	= No.65 [003].
V519	Per =	73045	= BD+56°502 (9.1) = SAO 023165 (B5) = Oo 717 (h,χ Per) [257] = GSC 3694.2413.
V520	Per =	73047	= HD 14134 (B0) = BD+56°522 (6.8) = SAO 023178 = Oo 1057 (h,χ Per) [257] = HIP 010805 = GSC 3694.1824.
V521	Per =	73058	= HR 933 = HD 19279 (A0) [258] = BD+46°692 (6.4) = SAO 038587 = GSC 3314.1278.
V522	Per =	73061	= HE 373 (α Per) [259] = GSC 3315.1080.
V523	Per =	73062	= AP 91 (α Per) [260] = GSC 3315.1463.
V524	Per =	73063	= AP 124 (α Per) [259] = GSC 3319.0304.
V525	Per =	73064	= AP 93 (α Per) [260,262] = GSC 3315.2218.
V526	Per =	73066	= AP 95 (α Per) [261] = GSC 3319.1842.
V527	Per =	73067	= AP 127 (α Per) [259] = GSC 3315.2520.
V528	Per =	73068	= AP 100 (α Per) [260,262] = GSC 3315.2204.
V529	Per =	73069	= AP 139 (α Per) [260,262] = GSC 3315.1989.
V530	Per =	73070	= AP 149 (α Per) [259,262] = GSC 3320.1643.
V531	Per =	73071	= AP 19 (α Per) [259] = HE 622 (α Per) [262] = GSC 3320.1283.
V532	Per =	73072	= HE 699 (α Per) [262] = GSC 3320.0545.
V533	Per =	73073	= AP 60 (α Per) [260].
V534	Per =	73074	= AP 63 (α Per) [259] = GSC 3320.1081.
V535	Per =	73075	= AP 167 (α Per) [263] = GSC 3316.1185.

Table 2 (continued)

V536	Per =	73077	= AP 117 (α Per) [259,262] = GSC 3320.1759.
V537	Per =	73081	= AP 118 (α Per) [262] = GSC 3320.1725.
V538	Per =	73082	= AP 201 (α Per) [263] = GSC 3320.1296.
V539	Per =	73084	= AP 212 (α Per) [263] = GSC 3321.1940.
V540	Per =	73086	= AP 225 (α Per) [262] = GSC 3321.2115.
V541	Per =	73087	= AP 226 (α Per) [259,262] = GSC 3317.0377.
V542	Per =	73089	= AP 244 (α Per) [259] = GSC 3317.1215.
V543	Per =	73092	= AP 258 (α Per) [260] = GSC 3326.2163?
V544	Per =	73106	= CCS 184 [264] = SVS 2422 = IRAS 04085+5102 = GSC 3340.0962.
V545	Per =	73114	= HR 1328 [265] = HD 27026 (B8) = BD+41°844 (6.4) = SAO 039447 = GSC 2886.2036.
V546	Per =	73123	= Gliese 170 [018] = G 81-21 = LHS 1674 = Ross 594 = GSC 2884.0349.
BG	Phe =	73024	= CoD−56°152 (9.4) = CPD−56°154 (8.8) [266] = SAO 232194 (B5) = JL 212 = HIP 003812 = GSC 8469.0098.
UU	Pic =	73149	= V 0514–5253 [015].
UV	Pic =	73151	= CoD−45°1928 (10) = EXOSAT 0519–4544 = EXO 051922–4544.4 [103] = GSC 8085.0116.
UW	Pic =	73157	= RE 0531–462 = 2RE J053137–462400 = RX J0531.5–4624 [268].
UX	Pic =	73198	= IRAS 05345–4406 [014] = RAFGL 4431S = GSC 7608.0885.
UY	Pic =	73199	= HD 37572 (G5) = CoD−48°1894 (8.3) = CPD−48°687 (8.1) = SAO 217430 = IRAS 05355–4759 = RE 0536–475 [269] = 2RE J053655–475802 = GSC 8090.0476 = GSC 8090.1488.
BI	Psc =	73006	= GB 781006B [270] = GBS 0008+13.
BK	Psc =	73020	= BD+9°73 (9.5) = LHS 1118 = RE 0039+103 [269] = 2RE J003939+103925 = GSC 0606.1422.
BL	Psc =	73022	= BD+8°102 (9.3) = RE 0044+093 [271] = 2RE J004403+093406 = GSC 0604.0483.
BM	Psc =	73033	= No.2 [003].
BN	Psc =	73036	= No.3 [003].
BO	Psc =	73039	= LDS 3315A = EXOSAT 0146+0608 = EXO 014630+0608.9 [103] = GSC 0035.0659.
BP	Psc =	73750	= IRAS 23198–0230 [033] = Stephenson Hα 202 = PDS 103 [155] = GSC 5244.0148.
BQ	Psc =	73756	= SX Phe type var [272].
BR	Psc =	73757	= BD+1°4774 (8.7) = SAO 128397 = IRAS 23466+0207 = Gliese 908 [018] = G 29-68 = LHS 550 = LFT 1828 = LTT 17014 = Laland 1828 = NSV 14719 = GSC 0586.0610.
BS	Psc =	73758	= BD−1°4493 (9.5) = 1E 2349.8–0112 [005] = GSC 5253.0969.
BT	Psc =	73770	= HD 224638 (F0) [273,362] = BD−2°6071 (7.2) = SAO 147016 = GSC 5253.1139.
BU	Psc =	73771	= HD 224945 (A3) [273] = BD−3°5750 (7.2) = SAO 147045 = GSC 4666.0098 = GSC 4666.0738.
UV	PsA =	73721	= HD 213204 (F0) [067] = CoD−31°18846 (7.9) = CPD−31°6676 (8.0) = SAO 213868 = GSC 7497.0910.
UW	PsA =	73725	= HD 213655 (F0) [067] = CoD−30°19208 (7.3) = CPD−30°6651 (7.8) = SAO 191223 = GSC 6969.1055.
V354	Pup =	73231	= PNN of NGC 2452 [274] = PK 243 − 1°1 = He 2-4 = IRAS 07453–2712.
V355	Pup =	73235	= HD 67290 (A3) [067] = BD−19°2245 (8.2) = CPD−19°3102 (8.4) = SAO 175178 = GSC 6003.2759.
WX	Pyx =	73240	= 1E 0830.9–2238 [275] = PYX 2.
WY	Pyx =	73241	= PC 4 [030] = IRAS 08348–3617 = CSS 320 = NSV 04154 = GSC 7148.3970.
WZ	Pyx =	73248	= ELHS 2067 [276] = IRAS 08517–2436.
XX	Pyx =	73249	= CoD−24°7599 (9.7) [277] = CPD−24°3912 (10.0) = GSC 6589.0261.
TW	Ret =	73112	= IRAS 04120–6516 [033].
TX	Ret =	73116	= HD 27545 (F0) [067] = CoD−64°148 (8.2) = CPD−64°317 (7.5) = SAO 248978 = GSC 8872.1543.
TY	Ret =	73119	= IRAS 04238–6713 [033] = GSC 8875.1594.
TZ	Ret =	73138	= R4 [278]. Probable non-member of the Reticulum system, might be a distant member of the LMC.

Table 2 (continued)

V336	Sge =	73581	= HD 230990 (F0) [279] = BD+17°3901 (8.9) = SAO 104652 = GSC 1603.1333.
V337	Sge =	73608	= IRAS 19459+1716 [029].
V4334	Sgr =	73492	= Sakurai's object [280, *Sakurai*] = Novalike star in Sgr. $21\overset{\mathrm{m}}{.}0$ on ESO/SRC *J* plate of May 30/31, 1976. Brightened considerably by early 1995, then continued brightening, becoming gradually redder. A hint to oscillations in late 1996–1997. The central star of an old planetary nebula. A candidate final-helium-flash object. Resembles FG Sge, but shows more rapid development.
V4335	Sgr =	73494	= IRAS 17551–2909 [281].
V4336	Sgr =	73496	= IRAS 17559–2848 [281].
V4337	Sgr =	73497	= IRAS 17560–2916 [281].
V4338	Sgr =	73498	= Liller's Nova candidate = Possible Nova Sgr 1990 [283].
V4339	Sgr =	73499	= IRAS 17566–2852 [281].
V4340	Sgr =	73501	= IRAS 17578–2900 [281].
V4341	Sgr =	73502	= IRAS 17578–2914 [281].
V4342	Sgr =	73517	= F 15 (NGC 6558 field) [284].
V4343	Sgr =	73518	= F 14 (NGC 6558 field) [284].
V4344	Sgr =	73520	= Rosino 12 [285] = F 3 (NGC 6558 field) [284] = NSV 10278.
V4345	Sgr =	73521	= F 13 (NGC 6558 field) [284].
V4346	Sgr =	73522	= F 23 (NGC 6558 field) [284].
V4347	Sgr =	73523	= F 16 (NGC 6558 field) [284].
V4348	Sgr =	73524	= F 44 (NGC 6558 field) [284].
V4349	Sgr =	73525	= F 17 (NGC 6558 field) [284].
V4350	Sgr =	73526	= Rosino 21 [285] = F 9 (NGC 6558 field) [284].
V4351	Sgr =	73527	= F 32 (NGC 6558 field) [284].
V4352	Sgr =	73528	= F 41 (NGC 6558 field) [284].
V4353	Sgr =	73529	= Rosino 16 [285] = F 5 (NGC 6558 field) [284].
V4354	Sgr =	73530	= Rosino 10 [285] = F 1 (NGC 6558 field) [284].
V4355	Sgr =	73531	= F 39 (NGC 6558 field) [284].
V4356	Sgr =	73532	= F 43 (NGC 6558 field) [284].
V4357	Sgr =	73533	= F 12 (NGC 6558 field) [284].
V4358	Sgr =	73534	= Rosino 15 [285] = F 4 (NGC 6558 field) [284].
V4359	Sgr =	73535	= F 18 (NGC 6558 field) [284].
V4360	Sgr =	73542	= No.239 [286].
V4361	Sgr =	73545	= Nova Sgr 1996 [287, *Sakurai*].
V4362	Sgr =	73552	= Nova Sgr 1994 No.2 [288, *Sakurai*].
V4363	Sgr =	73553	= F 6 (NGC 6642 field) [289].
V4364	Sgr =	73554	= F 3 (NGC 6642 field) [289].
V4365	Sgr =	73555	= F 11 (NGC 6642 field) [289].
V4366	Sgr =	73556	= F 2 (NGC 6642 field) [289].
V4367	Sgr =	73557	= F 5 (NGC 6642 field) [289].
V4368	Sgr =	73571	= Peculiar var in Sgr [375, *Wakuda*].
V4369	Sgr =	73574	= SV 5 in Sgr Galaxy [118]. Foreground star.
V4370	Sgr =	73576	= SV 10 in Sgr Galaxy [118]. Non-member of the Sgr Galaxy?
V4371	Sgr =	73600	= HD 181943 (G5) [293] = BD−14°5413 (9.0) = SAO 162546 = GSC 5721.0030.
V4372	Sgr =	73602	= HD 183133 (B3) [294] = BD−15°5362 (7.2) = SAO 162651 = HIP 095755 = GSC 6298.2535.
V4373	Sgr =	73605	= HD 185256 (F0) [295] = CoD−30°17252 (9.3) = CPD−30°6070 (9.1) = GSC 6901.1033.
V4374	Sgr =	73622	= HD 192825 (G0) = CoD−28°16553 (8.5) = CPD−28°7177 (8.6) = SAO 189111 [296] = GSC 6918.0817.
V1026	Sco =	73393	= HD 142666 (A3) = BD−21°4228 (8.6) = CPD−21°6063 (8.4) = SAO 183956 = IRAS 15537–2153 = BV 536 = NSV 07344 = GSC 6199.0618 [157].
V1027	Sco =	73402	= HR 6000 [297] = HD 144667 (A0) = CoD−38°10894 (7.0) = CPD−38°6374 (7.5) = SAO 207368 = IDS 1601.9S3849A = GSC 7851.1817.
V1028	Sco =	73418	= HD 148199 (B9) [298] = CoD−29°12551 (7.5) = CPD−29°4425 (7.2) = SAO 184398 = GSC 6806.0600.
V1029	Sco =	73420	= Ton 4 [299] = NSV 07742.

Table 2 (continued)

V1030	Sco =	73421	= Ton 7 in the ρ Oph region [209].
V1031	Sco =	73425	= Ton 8 in the ρ Oph region [209].
V1032	Sco =	73441	= CPD−41°7711 (9.8) = Seggewiss 282 (NGC 6231) [300] = Braes 930 = GSC 7876.2681.
V1033	Sco =	73442	= X-ray Nova Sco 1994 [302] = GRO J1655–40 [301].
V1034	Sco =	73443	= CPD−41°7742 (8.4) = Seggewiss 224 (NGC 6231) [300] = Braes 945 = NSV 08024 = GSC 7876.2289.
V1035	Sco =	73460	= HD 156327 (Oa) = CoD−34°11622 (9.0) = CPD−34°6800 (9.2) = SAO 208655 = WR 86 [303] = He 3-1368 = LSS 4057 = GSC 7370.0511.
V1036	Sco =	73469	= HR 6535 = HD 159176 (Oe5) [304] = CoD−32°12935 (5.8) = CPD−32°4616 (6.6) = SAO 208977 = IDS 1728.2S3231 = LSS 4225 = Eggen 1 (NGC 6383) = Prager 4357 = CSV 101659 = NSV 09167 = HIP 086011 = GSC 7380.1077.
V1037	Sco =	73471	= HD 320156 (B0) = CoD−35°11760 (9.3) [376] = CPD−35°7069 (9.2) = SAO 209052 = IRAS 17346-3521 = He 3-1444 = LSS 4300 = Wray 15-1745 = GSC 7384.0832.
V1038	Sco =	73490	= IRAS 17485–4213 [116].
AY	Scl =	73001	= IRAS 00016–3056 [306] = GSC 6989.0711.
AZ	Scl =	73025	= CoD−37°316 (10) = SB 357 [307] = GSC 7000.1427.
BB	Scl =	73038	= HD 9770 (G5) = CoD−30°529 (7.4) = CPD−30°181 (7.6) = SAO 193189 = IRAS 01326–3010 = Gliese 60ABC [055] = 2RE J013501–295427 = NSV 00556 = HIP 007372 = GSC 6428.1616.
α	Scl=	73027	= alpha Scl [308] = HR 280 = HD 5737 (B5) = CoD−30°297 (4.2) = CPD−30°99 (3.5) = SAO 166716 = IRAS 00561–2937 = NSV 00359 = GSC 6424.2270.
σ	Scl=	73029	= sigma Scl [308] = HR 293 = HD 6178 (A2) = CoD−32°410 (5.6) = CPD−32°108 (5.6) = SAO 192884 = GSC 6999.2321.
V446	Sct =	73548	= MWC 930 [133] = IRAS 18237–0715 = GSC 5111.0068.
V447	Sct =	73568	= HD 173219 (B0p) [309] = BD−7°4689 (8.2) = SAO 142567 = MWC 304 = LS IV−7°16 = GSC 5125.0325.
NY	Ser =	73383	= PG 1510+234 [310] = SER 1 = HV 10444 = CSV 2297 = NSV 06990.
NZ	Ser =	73549	= MWC 297 [311] = AFGL 2165 = IRAS 18250–0351 = GSC 5107.0494.
OO	Ser =	73551	= DEOS Ser [313].
TU	Sex =	73268	= V 31 in Sex dSph Galaxy [314]. Non-member of the galaxy.
V1082	Tau =	73088	= HD 22694 (G5) = BD+17°601 (8.3) = SAO 093538 = HIC 017076 [005] = GSC 1239.0265.
V1083	Tau =	73090	= IRAS 03410+0646 [014].
V1084	Tau =	73091	= HII 320 (Pleiades) [263] = Zinner 212 = CSV 100304 = NSV 01255 = GSC 1803.0222.
V1085	Tau =	73094	= BD+23°511 (9.0) = SAO 076151 (F2) = HII 708 (Pleiades) [259] = Zinner 215 = CSV 100308 = NSV 01274 = GSC 1799.0974.
V1086	Tau =	73095	= No.7 [003].
V1087	Tau =	73096	= K4 (Pleiades) [316] = TCSN 261 = Plf 545.
V1088	Tau =	73098	= Plf 345 [318] = NSV 01350.
V1089	Tau =	73099	= HII 2284 (Pleiades) [263] = Zinner 241 = CSV 100338 = NSV 01353 = GSC 1800.1249.
V1090	Tau =	73100	= HII 2341 (Pleiades) [263] = Zinner 243 = CSV 100340 = NSV 01356 = GSC 1800.1128.
V1091	Tau =	73101	= Flare star in the Pleiades region [319] = Pels 72 [320] = GSC 1804.0734.
V1092	Tau =	73102	= 2RE J0357+283 [321] = RE 0357+283 = GSC 1825.1142.
V1093	Tau =	73103	= No.8 [003].
V1094	Tau =	73107	= HD 284195 (G0) = BD+21°605 (9.1) = SAO 076494 = DHK 41 [174] = GSC 1263.0642.
V1095	Tau =	73108	= LkCa 1 [323] = JH 141 = HBC 365 = GSC 1827.1092.
V1096	Tau =	73109	= Anon 1 [323] = Anon (near LkCa 1) = HBC 366 = GSC 1827.1209.
V1097	Tau =	73110	= LkCa 2 [323,324] = GSC 1827.1087.
V1098	Tau =	73111	= LkCa 3 [325,377] = HBC 368 = GSC 1823.1802.
V1099	Tau =	73113	= 48 Tau = HR 1319 [326] = HD 26911 (F5) = BD+15°603 (6.3) = SAO 093836 = VB 20 = VA 79 (Hyades) = CSV 100377 = NSV 01537 = GSC 1251.0128.

Table 2 (continued)

V1100	Tau =	73117	= DHK 42 [256] = IRAS 04184+2008 = GSC 1272.0567.
V1101	Tau =	73118	= B 29 [327] = GSC 1277.1228.
V1102	Tau =	73120	= VA 486 (Hyades) [263] = GH 7-232 = Leiden 68 = GSC 1269.1045.
V1103	Tau =	73121	= LkCa 11 [323] = GSC 1269.0045.
V1104	Tau =	73122	= VA 512 (Hyades) [263] = GH 7-236 = GSC 1265.1019.
V1105	Tau =	73124	= B 75 [330].
V1106	Tau =	73125	= B 33 [327] = GSC 1829.0152.
V1107	Tau =	73126	= B 28 [327].
V1108	Tau =	73127	= B 19 [327] = GSC 1278.0382.
V1109	Tau =	73128	= B 21 [327] = GSC 1278.0940.
V1110	Tau =	73129	= BD+24°667 (9.5) = Wa Tau 1 [005,378] = TAP 50 = HBC 408 = GSC 1833.0934.
V1111	Tau =	73130	= B 71 [330].
V1112	Tau =	73131	= HV 10389 = CSV 418 = NSV 01651 = GSC 0669.1442.
V1113	Tau =	73132	= B 60 [330].
V1114	Tau =	73134	= B 52 [330] = GSC 1829.0768.
V1115	Tau =	73135	= LkCa 14 [325] = HBC 417 = GSC 1834.0177.
V1116	Tau =	73136	= HR 1459 [326] = HD 29169 (F2) = BD+23°715 (6.5) = SAO 076670 = VB 100 (Hyades) = NSV 01663 = GSC 1830.2128.
V1117	Tau =	73137	= B 47 [330] = GSC 1830.1257.
V1118	Tau =	73139	= B 43 [327] = GSC 1830.0822.
V1119	Tau =	73152	= 111 Tau [242] = HR 1780 = HD 35296 (G0) = BD+17°920 (5.5) = SAO 094526 = IDS 0518.6N1716A = IRAS 05214+1720 = Gliese 202 = HIP 025278 = GSC 1300.2225.
QT	Tel =	73611	= IRAS 19521–5131 [033] = GSC 8403.1440.
QU	Tel =	73615	= EC 20058–5234 [332] = GSC 8404.0125.
XY	Tri =	73041	= No.4 [003].
XZ	Tri =	73042	= No.5 [003].
YY	Tri =	73046	= IRAS 02152+2822 [014].
CP	Tuc =	73745	= AX J2315–592 [379] = AS 2315–5910.
EW	UMa =	73236	= BD+73°405 (9.5) = GSC 4380.1353 [062].
EX	UMa =	73245	= BV 28 = CSV 6652 = NSV 04219 = GSC 3801.1644.
EY	UMa =	73250	= GR 304 [336].
EZ	UMa =	73256	= HR 3722 = HD 80953 (K2) = BD+64°733 (6.5) = SAO 014875 = IRC+60194 = AFGL 1350 = IRAS 09217+6409 = HIC 046247 [005] = GSC 4138.1441.
FF	UMa =	73260	= HD 82286 (G5) = BD+63°848 (8.2) = SAO 014919 = RE 0933+624 = HIC 046919 [005] = GSC 4139.0905.
FG	UMa =	73269	= HD 89546 (K0) = BD+61°1183 (7.3) = SAO 015153 = IRAS 10183+6109 = HIC 050752 [005] = GSC 4144.1153.
FH	UMa =	73277	= WGA J1047.1+6335 [337].
FI	UMa =	73283	= HR 4344 [338] = HD 97302 (A2) = BD+55°1446 (6.7) = SAO 027952 = GSC 3824.1050.
FK	UMa =	73284	= BD+30°2130 (8.9) = HIC 055135 [005] = GSC 1983.0061.
MN	Vel =	73242	= HD 73739 (Ma) = CoD−46°4393 (7.6) = CPD−46°2759 (8.6) = SAO 220216 = IRAS 08363–4643 = CSV 6649 = NSV 04166 = GSC 8155.0343 [157].
MO	Vel =	73247	= HD 75425 (A0) [339] = CoD−41°4521 (9.3) = CPD−41°2994 (8.9) = SAO 220501 = GSC 7683.0055.
MP	Vel =	73253	= HD 79185 (F0) [067] = CoD−42°5040 (8.2) = CPD−42°3432 (7.4) = SAO 220929 = GSC 7690.2860.
MQ	Vel =	73255	= IRAS 09194–4518 [029].
MR	Vel =	73257	= RX J0925.7–4758 [340].
MS	Vel =	73262	= HD 83388 (Ma) = CoD−51°3979 (8.1) = CPD−51°2403 (8.7) = SAO 237135 = IRAS 09345–5219 = HIP 047131 = GSC 8585.1054 [157].
MT	Vel =	73263	= HD 84712 (F0) [067] = CoD−45°5401 (8.2) = CPD−45°4005 (8.2) = SAO 221465 = HIP 047889 = GSC 8181.1795.
MU	Vel =	73264	= IRAS 09450–4716 [029].
MV	Vel =	73270	= I Vel = HR 4074 [309] = HD 89890 (B5p) = CoD−55°3306 (4.4) = CPD−55°3286 (4.8) = SAO 237959 = MWC 201 = GSC 8604.0975.

Table 2 (continued)

MW	Vel =	73282	= HD 96134 (Mc) = CoD−50°5655 (8.9) = CPD−50°3921 (9.2) = ISS 370 = IRAS 11022–5057 = GSC 8212.1230 [157].
IQ	Vir =	73289	= HR 4555 = HD 103313 (A5) [067] = BD+1°2624 (6.8) = SAO 119100 = GSC 0273.0621.
IR	Vir =	73330	= HV 10097 = CSV 1901 = NSV 05798 = GSC 4951.0769.
IS	Vir =	73356	= HD 113816 (K0) = BD−4°3419 (8.4) = SAO 139157 = 1H 1303–047 = HIC 063958 [005] = CSV 6993 = NSV 06095 = GSC 4960.1185.
IT	Vir =	73365	= HD 121447 (Map) [342] = BD−17°3961 (8.0) = SAO 158240 = IRAS 13530-1800 = HIP 068023 = GSC 6140.0641.
IU	Vir =	73368	= EC 14012–1446 [343].
IV	Vir =	73370	= BD−21°3873 (9.6) [344] = GSC 6151.1012.
V376	Vul =	73582	= CCS 2714 = IRAS 19131+2507 = TASV 1913+25 [346] = GSC 2127.2488.
V377	Vul =	73601	= 3 Vul [347] = HR 7358 = HD 182255 (B5) = BD+25°3811 (5.5) = SAO 087136 = EUVE J1922+26.2 = HIP 095260 = CSV 102926 = NSV 11966 = GSC 2132.3895.
V378	Vul =	73603	= Roberts 93 [348] = WR 125 = GSC 1609.0416.
V379	Vul =	73609	= HR 7556 [349] = HD 187640 (B8) = BD+28°3493 (6.8) = SAO 087786 = HIP 097572 = NSV 12454 = GSC 2152.6207.
V380	Vul =	73610	= LD 144 [350].
V381	Vul =	73617	= Star 19 (NGC 6882/5) [351] = GSC 2162.0948.
V382	Vul =	73618	= BD+26°3819 (9.4) = Star 25 (NGC 6882/5) [351] = GSC 2162.1074.
V383	Vul =	73621	= HD 192871 (A5) [279] = BD+21°4133 (7.0) = SAO 088437 = HIP 099923 = GSC 1643.0019.
V384	Vul =	73662	= No.49 [003] = GSC 2181.0129.
V385	Vul =	73674	= No.50 [003].
V386	Vul =	73676	= No.51 [003].

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ERRATUM

Dr. G. Williams has revealed a misprint in the 73rd Name-List of newly designated variable stars (IBVS No. 4471). In the introductory part, when listing mistakes in the earlier Name-Lists, V353 Pup was claimed to be NSV 03431. The correct cross-identification is, however, V353 Pup = NSV 03731.

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PHOTOELECTRIC MINIMA OF SELECTED ECLIPSING BINARIES AND MAXIMA OF PULSATING STARS

(BAV Mitteilungen No. 99)

In this 33rd compilation of BAV results, photoelectric observations obtained in the years 1996 and 1997 are presented on 93 variable stars giving 151 minima and maxima. All times of minima and maxima are heliocentric. The errors are tabulated in column "±". The values in column O−C are determined without incorporation of nonlinear terms. The references are given in the section "remarks". All information about photometers and filters are specified in the column "Rem". The observations were made at private observatories. The photoelectric measurements and all the lightcurves with evaluations can be obtained from the office of the BAV for inspection.

Table 1. Eclipsing binaries

Variable		Min JD 24..	+/−	Ph	Obs	O–C		GCVS	Rem
LO	And	50422.2818	.0004	LB	AG	−0.0811		GCVS 85	2)
		50422.2820	.0007	LV	AG	−0.0809		GCVS 85	2)
ST	Aqr	50394.2435		L	KI	−0.0228		GCVS 85	1)
CX	Aqr	50369.3328		L	KI	−0.0008		GCVS 85	1)
V346	Aql	50343.3329		L	KI	−0.0053		GCVS 85	1)
V417	Aql	50303.4155		L	KI	−0.0415		BAVR 9)	1)
		50315.4511	.0003	LB	AG	−0.0411	s	BAVR 9)	2)
		50315.4517	.0005	LV	AG	−0.0405	s	BAVR 9)	2)
V609	Aql	50299.4307		L	KI	−0.0225		GCVS 85	1)
V724	Aql	50301.3793		L	KI	−0.0037	s	BAVM 57	1)
AP	Aur	50096.4104		L	MS	+0.0033	s	BAVM 67	1)
CG	Aur	50100.3663		L	MS	+0.0277	s	GCVS 85	1)
GX	Aur	50098.3305		L	MS	−0.0123	s	BAVM 69	1)
		50158.3524		L	MS	−0.0111		BAVM 69	1)
IU	Aur	50381.4989	.0005	LV	AG	−0.0013	s	GCVS 85	2)
		50381.4998	.0009	LB	AG	−0.0004	s	GCVS 85	2)
NSV2733	Aur	50096.2680		L	MS				1)
		50101.5474		L	MS				1)
		50151.3335		L	MS				1)
TY	Boo	50150.4382		L	MS	−0.0052		BAVM 68	1)
VW	Boo	50086.6593		L	MS	−0.0229		BAVR 8)	1)
		50204.4183		L	KI	−0.0219		BAVR 8)	1)
AC	Boo	50190.4053		L	QU	−0.0458	s	GCVS 85	5)
		50193.4020		L	QU	−0.0448		GCVS 85	5)
FF	Cnc	50115.3770		L	FR	−0.0336		BAVM 65	1)
		50123.3163		L	FR	−0.0331		BAVM 65	1)
		50140.5146		L	FR	−0.0357		BAVM 65	1)
		50152.4265		L	FR	−0.0321		BAVM 65	1)
		50156.3948		L	FR	−0.0333		BAVM 65	1)
		50158.3724		L	FR	−0.0404	s	BAVM 65	1)
		50162.3462		L	FR	−0.0360	s	BAVM 65	1)

Table 1 (cont.)

Variable		Min JD 24..	+/−	Ph	Obs		O–C	GCVS	Rem
YY	CMi	50157.3659		L	KI		+0.0123	GCVS 85	1)
AK	CMi	50153.3079	.0003	LB	AG		−0.0128	GCVS 85	2)
		50153.3088	.0009	LV	AG		−0.0119	GCVS 85	2)
AV	CMi	50152.3325		L	KI		+0.0011	GCVS 85	1)
V359	Cas	50344.5852	.0003	L	AG		+0.1426	GCVS 85	1)
U	Cep	50203.394		L	PTT		+0.080	GCVS 85	4)
CW	Cep	50300.5001	.0008	LB	AG		+0.0193 s	GCVS 85	2)
		50300.5013	.0006	LV	AG		+0.0205 s	GCVS 85	2)
SS	Com	50199.4782		L	KI		+0.0339	BAVR 9)	1)
CC	Com	50188.4183		L	KI		−0.0086 s	GCVS 85	1)
NSV6177	Com	50187.4258		L	MS		+0.0106 s	BAVM 88	1)
		50249.4683		L	FR	MS	+0.0012	BAVM 88	1)
V370	Cyg	50153.6335		L	MS		−0.0115	GCVS 85	1)
V700	Cyg	50246.4825	.0003	L	AG		−0.0228	GCVS 85	1)
V961	Cyg	50152.6104		L	MS		−0.0617	GCVS 85	1)
		50153.6298		L	MS		−0.0612 s	GCVS 85	1)
EX	Del	50291.3807		L	KI		−0.0416	GCVS 85	1)
EF	Dra	50301.5180	.0006	LV	AG		+0.0085 s	BAVM 63	2)
		50301.5194	.0007	LB	AG		+0.0099 s	BAVM 63	2)
TT	Her	50249.4870		L	KI		+0.0267	GCVS 85	1)
AK	Her	50248.4941		L	KI		+0.0041	GCVS 85	1)
HS	Her	50281.500 :	.002	LB	AG		+0.807	GCVS 85	2)
		50281.500 :	.002	LV	AG		+0.807	GCVS 85	2)
		50304.426 :	.002	LB	AG		+0.809	GCVS 85	2)
		50304.427 :	.002	LV	AG		+0.810	GCVS 85	2)
		50313.4287	.0003	LV	AG		−0.0132	GCVS 85	2)
		50313.4293	.0003	LB	AG		−0.0126	GCVS 85	2)
DHK40	Her	50251.5088	.0003	LB	AG				2)
		50251.5090	.0004	LV	AG				2)
		50291.4891	.0014	LV	AG				2)
		50291.4924	.0011	LB	AG				2)
NSV7457	Her	50144.3803		L	MS				1)
		50144.5898		L	MS				1)
		50151.5038		L	MS				1)
FG	Hya	50156.3407		L	KI		−0.0410 s	GCVS 85	1)
CO	Lac	50248.4857	.0007	LV	AG		+0.0097 s	GCVS 85	2)
		50248.4860	.0004	LB	AG		+0.0100 s	GCVS 85	2)
UV	Leo	50190.4029		L	KI		+0.0166	GCVS 85	1)
XY	Leo	50173.4305		L	KI		−0.0313	GCVS 85	1)
		50180.3974		L	KI		−0.0247 s	GCVS 85	1)
XZ	Leo	50175.3742		L	KI		+0.0213	GCVS 85	1)
AP	Leo	50178.3981		L	KI		−0.0266	GCVS 85	1)
RT	LMi	50154.3495		L	MS		−0.0009 s	GCVS 85	1)
V404	Lyr	50158.5502		L	MS		−0.0648	GCVS 85	1)
		50248.4586	.0001	L	AG		−0.0627	GCVS 85	1)
BO	Mon	50154.268 :		L	KI		−0.059	GCVS 85	1)
V449	Oph	50251.5146		L	KI		+0.0327	GCVS 85	1)
V508	Oph	50250.4693		L	KI		+0.0095 s	GCVS 85	1)
V566	Oph	50252.4837		L	KI		+0.0417	GCVS 85	1)
V839	Oph	50284.4612		L	KI		−0.0846 s	GCVS 85	1)
V1016	Ori	50080.494		L	PTT		+0.067	GCVS 85	4)
ZZ	Peg	49934.4658		L	MSR		+0.1310	GCVS 87	1)
V482	Per	50106.2985		L	MS		+0.0346	BAVM 68	1)
CU	Sge	50283.4426		L	KI		+0.0150	GCVS 87	1)
CW	Sge	50279.4305	.0017	LB	AG		−0.0898 s	GCVS 87	2)
		50279.4346	.0017	LV	AG		−0.0857 s	GCVS 87	2)

Table 1 (cont.)

Variable		Min JD 24..	+/−	Ph	Obs	O–C	GCVS	Rem
RS	Sct	50286.4524		L	KI	+0.0032	GCVS 87	1)
DK	Sct	50287.4765		L	KI	+0.0311	GCVS 87	1)
CU	Tau	49710.2821		L	MS	−0.0758	GCVS 87	1)
		49710.4866		L	MS	−0.0774 s	GCVS 87	1)
		49721.4198		L	MS	−0.0680	GCVS 87	1)
		49722.2436		L	MS	−0.0687	GCVS 87	1)
		49722.4498		L	MS	−0.0686 s	GCVS 87	1)
		49723.2743	.0003	L	AG	−0.0685 s	GCVS 87	1)
		50114.3675	.0003	L	AG	+0.0340	GCVS 87	1)
		50115.3979	.0003	L	AG	+0.0338 s	GCVS 87	1)
HU	Tau	50043.392		L	QU	+0.008	GCVS 87	5)
TX	UMa	50141.4465		L	KRW	+0.1221	GCVS 87	5)
TY	UMa	50192.5267		L	FR	−0.0594 s	GCVS 87	1)
		50193.5905		L	FR	−0.0592 s	GCVS 87	1)
		50194.4775		L	FR	−0.0586	GCVS 87	1)
		50195.3645		L	FR	−0.0579 s	GCVS 87	1)
		50195.5409		L	FR	−0.0588	GCVS 87	1)
UY	UMa	50142.4061		L	MS	+0.0563 s	GCVS 87	1)
		50142.5929		L	MS	+0.0551	GCVS 87	1)
		50152.3668		L	MS	+0.0526	GCVS 87	1)
		50192.4160		L	MS	+0.0561 s	GCVS 87	1)

Table 2. Pulsating Stars

Variable		Max JD 24..	+/−	Ph	Obs	O–C	GCVS	Rem
OV	And	50115.2449		L	BK	−0.0038	MVS11,133	5)
XX	Boo	50249.4483		L	BK	+0.0196	GCVS 85	5)
CM	Boo	50195.3938		L	QU	−0.0342	BAVM 75	5)
CS	Boo	50088.6621		L	MS	−0.0041	IBVS 2855	1)
NSV6836	Boo	50175.5082		L	MS			1)
NSV7020	Boo	50190.4655		L	MS			1)
		50200.5584		L	MS			1)
HD32456	Cam	50150.5520		LB	GB	+0.0089	BAVM 84	7)
		50150.5600		LV	GB	+0.0169	BAVM 84	7)
AQ	Cnc	50186.4045		L	BK	−0.0474	GCVS 85	5)
RZ	CVn	50152.4306		L	KRW	−0.2543	GCVS 85	5)
ST	CVn	50153.500		L	PS	−0.061	GCVS 85	3)red
AD	CMi	50153.3664		L	KI	+0.0072	GCVS 85	1)
RV	CrB	50153.4574		L	MS	+0.0011	GCVS 85	1)
V798	Cyg	50314.4909		L	BK	−0.0680	GCVS 85	5)
GI	Gem	50081.5076		L	BK	+0.0685	GCVS 85	5)
		50153.4273		L	BK	+0.0661	GCVS 85	5)
BD	Her	50282.5358		L	KI	+0.0857	GCVS 85	1)
		50300.5499		L	BK	+0.0913	GCVS 85	5)
DL	Her	50247.4852		L	KI	+0.0217	GCVS 85	1)
LS	Her	50252.5143		L	BK	+0.0122	GCVS 85	5)
V418	Her	50301.4673		L	BK	+0.0354	GCVS 85	5)
ET	Hya	50151.4937		L	BK	+0.1043	GCVS 85	5)
DE	Lac	50313.5138		L	BK	+0.0187	GCVS 85	5)
RR	Leo	50170.4459		L	QU	+0.0229	GCVS 85	5)
		50194.4204		L	QU	+0.0206	GCVS 85	5)
ST	Leo	50166.585		L	PS	−0.010	GCVS 85	3)
		50192.3934		L	KI	−0.0131	GCVS 85	1)
SZ	Leo	50224.4201		L	BK	+0.2455	GCVS 85	5)
AA	Leo	50166.465		L	PS	−0.055	GCVS 85	3)

Table 2 (cont.)

Variable		Max JD 24..	+/−	Ph	Obs	O–C	GCVS	Rem
AX	Leo	50189.4212		L	BK	−0.0187	GCVS 85	5)
BX	Leo	50188.4399		L	BK	+0.0186	GCVS 85	5)
Y	LMi	50146.3529		L	BK	+0.0548	GCVS 85	5)
		50170.4954		L	BK	+0.0716	GCVS 85	5)
		50190.4066		L	BK	+0.0529	GCVS 85	5)
EH	Lib	50283.3665		L	SG	+0.0018	GCVS 85	6)
RW	Lyn	50175.3572		L	BK	+0.0132	BAVM 75	5)
EX	Lyr	50303.5011		L	BK	+0.0664	GCVS 85	5)
V462	Lyr	50287.5089		L	BK	+0.0616	GCVS 85	5)
V567	Oph	50286.5046		L	BK	+0.0624	GCVS 85	5)
FU	Vir	50170.5380		L	MS	+0.1865	GCVS 87	1)
		50193.5098		L	MS	+0.1839	GCVS 87	1)
		50200.4203		L	MS	+0.2021	GCVS 87	1)

Remarks:

AG	Agerer, F.	Tiefenbach	MS	Moschner, W.	Lennestadt
BK	Birkner, C.	Hagen	MSR	Moschner, J.	Lennestadt
PS	Paschke, A.	Rueti CH	FR	Frank, P.	Velden
PTT	Petter, Dr.G.	Dresden	GB	Groebel, R.	Eckental
QU	Quester, W.	Esslingen	KI	Kleikamp, W.	Marl
SG	Sterzinger, Dr.P.	Wien A	KRW	Krawietz, A.	Hartha

:	= uncertain
s	= secondary minimum
L	= photoelectric observation - without filter
LB	= as above - filter: B
LV	= as above - filter: V
red	= reduced results
1)	= photometer CCD 375x242 uncoated - without filter
2)	= photometer EMI 9781A - filter: V=GG495,1mm; B=BG12,1mm+GG385,2mm
3)	= photometer Cryocam 89A - without filter
4)	= photometer TC-211 - without filter
5)	= photometer ST-7 - without filter
6)	= photometer SSP5
7)	= photometer 1P21 - filter: V=GG14,2mm; B=BG12,1mm+GG13,2mm
BAVM nn	= BAV Mitteilungen No. nn
BAVM 57	= BAV Mitteilungen No. 57 = IBVS No. 3555
BAVM 63	= BAV Mitteilungen No. 63 = IBVS No. 3811
BAVM 65	= BAV Mitteilungen No. 65 = IBVS No. 3859
BAVM 67	= BAV Mitteilungen No. 67 = IBVS No. 3942
BAVM 84	= BAV Mitteilungen No. 84 = IBVS No. 4306
BAVM 88	= BAV Mitteilungen No. 88 = IBVS No. 4386
BAVR 8)	= BAV Rundbrief 32,122 ff
BAVR 9)	= BAV Rundbrief 33,152 ff
GCVS nn	= General Catalogue of Variable Stars, 4th ed. 19

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Erratum (from IBVS 6048)

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TY UMa          & 50192.5267 FR  & has to be deleted \\
TY UMa          & 50193.5905 FR  & has to be deleted \\
TY UMa          & 50194.4775 FR  & has to be deleted \\
TY UMa          & 50195.3645 FR  & has to be deleted \\
TY UMa          & 50195.5409 FR  & has to be deleted \\
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Konkoly Observatory
Budapest
30 April 1997

HU ISSN 0374 – 0676

GSC 4540_1553 IS A NEW BINARY STAR

CCD images taken at the Bohyunsan Optical Astronomy Observatory (BOAO) with the 1.8-m telescope and at the Kyung Hee Astronomy Observatory (KHAO) with the 0.76-m telescope on Jan. 21-Mar. 5, 1997 show that the star GSC 4540_1553 (V=15.22), located at R.A.=$08^h11^m42^s.66$, Decl.=$+76°04'53''.22$ (equinox 2000.0) varies in magnitude. From the preliminary analysis of the light curve, I derive the period of 1.1799 day with 0.52 mag (in R) variation in primary and 0.45 mag (in R) variation in secondary minimum using GSC 4540_2581 and GSC 4540_1931 as the comparisons. It is considered as an Algol type eclipsing binary star. The light curve shown is the combined data of Jan. 21-22, 24, 1997 and Feb. 1, 1997 using GSC 4540_2581 as a comparison. The average B−V colour index of this new variable is $0^m.03$ out of minima.

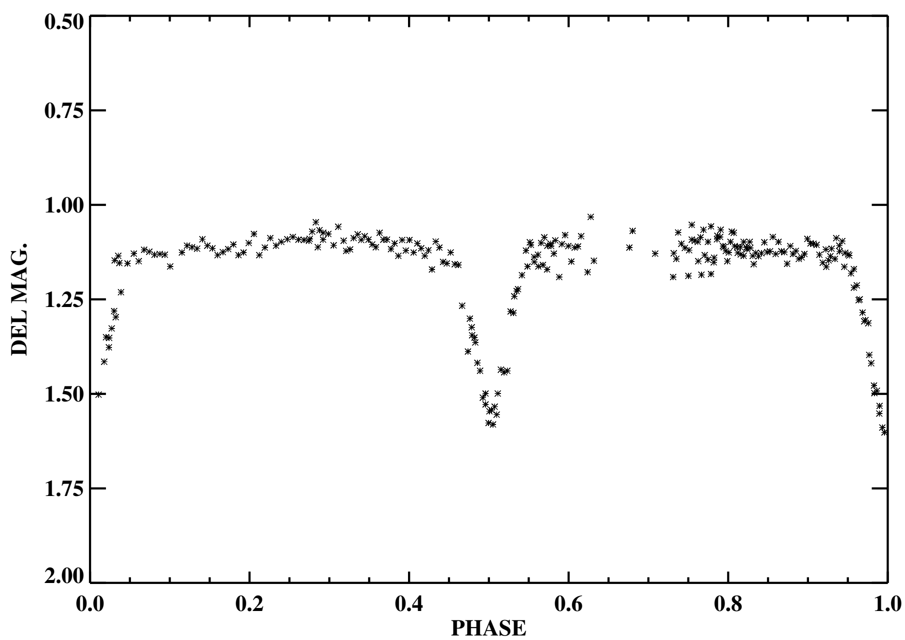

Figure 1. Light curve of the new variable. *R* filter data

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THE ECLIPSING BINARY STAR MS 1428.2+0732

The sky was surveyed in the X-ray region of the spectrum by the Einstein satellite, and the Extended Medium Sensitivity Survey (Stocke et al. 1991) included MS1428.2+0732 with the brightness given as 11.06 in V and the spectral type as F7V. This star is also listed in the Hubble Telescope Guide Star Catalog (GSC)(Jenkner et al., 1990) as GSC 0331_665.

The automated 0.5-m. telescope, Cousins R filter and CCD camera of the Climenhaga Observatory of the University of Victoria was used to make these photometric observations (Robb et al. 1992). The frames had the bias subtracted and were flat fielded in the usual manner using IRAF [1] . The magnitudes were found from aperture photometry using the package PHOT. The x y pixel coordinates of each star for photometry were found from inspection of a few frames and were used as starting points for the Gaussian centering option which precisely centered the 12 arc second aperture on each star for each frame.

The primary comparison star used was SAO 120507=GSC 0331_243 and the check star was GSC 0331_089. The precision of the photometry can be estimated from the standard deviation of the differences in R magnitude for these two stars for each night. This standard deviation varies from 0.011 on a clear night to 0.033 on a poor night. Night to night variations can be estimated from the mean and standard deviation of the nightly mean R magnitude differences between the comparison and check stars. The overall mean is -4.100 and the standard deviation of a night about this mean is 0.012. The uncertainty in a measurement between the comparison and variable star is usually smaller because the check star was fainter. Due to the small field of view first order extinction effects were negligible and no corrections have been made for them. Nor have corrections been made for the colour difference between the stars to transform it to a standard system.

Photometric observations were begun April 1994, continued on fifteen more nights in the spring of 1995, one night in 1996, and one night in 1997. Variations of brightness from night to night were soon obvious and the few long nights showed that the period of the variation must be more than a few hours. A sine curve was fit to various periods and reveals a minimum average chi squared at an inverse period of 1.21 ± 0.01 days^{-1}, as seen in Figure 1. This is half the orbital period and other minima in the figure correspond to aliases and multiples of the real period. Times of minimum light have been found from the method of Kwee and Van Woerden (1956) to be 2449481.7650(14), 2449499.9204(16), 2449859.7620(5) and 2450549.7339(8) which yield a period of:

$$\text{HJD of Primary Minimum} = 2449481.7640(6) + 1.650649(2) \times \text{E}$$

where the uncertainties in the final digit are given in brackets. These uncertainties have been underestimated, because no allowance has been made for the asymmetry in the

[1] IRAF is distributed by National Optical Astronomy Observatories, which is operated by the Association of Universities for Research in Astronomy, Inc., under contract to the National Science Foundation

minima. A plot of the differential R magnitudes phased at this period is shown in Figure 2 for the data from 1994 above and 1995 below. Different runs are plotted with different symbols so that brightness variations from night to night can be seen. The 1994 data have been shifted up 0.05 magnitudes, but the apparent difference between mean curves is about 0.09 magnitudes, indicating that most of the light curve has shifted fainter about 0.04 magnitudes from 1994 to 1995. The bottom of primary minimum was at an intermediate level in 1996 and 1997.

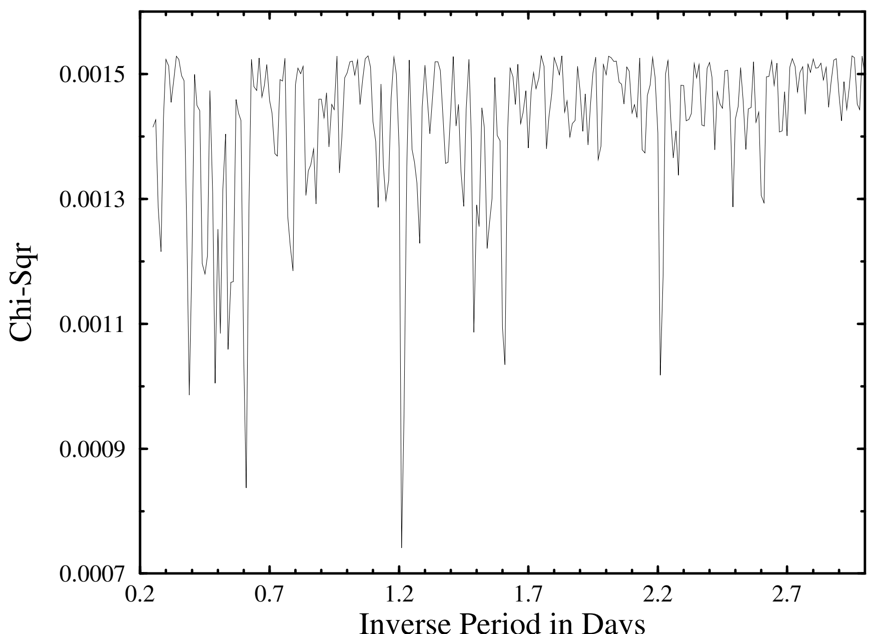

Figure 1. Chi squared fit to a single sine curve for various periods

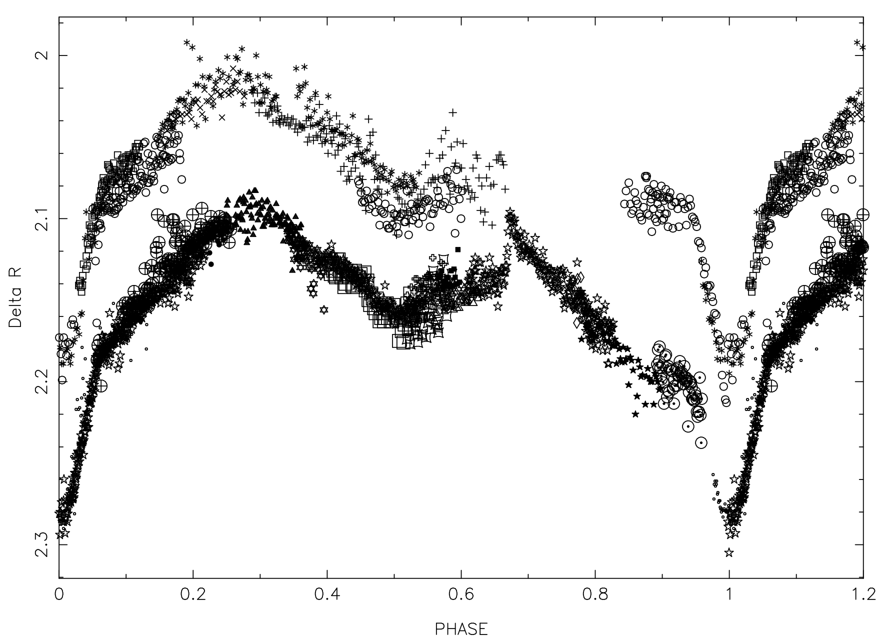

Figure 2. The light curve in R for 1994 above and 1995 below

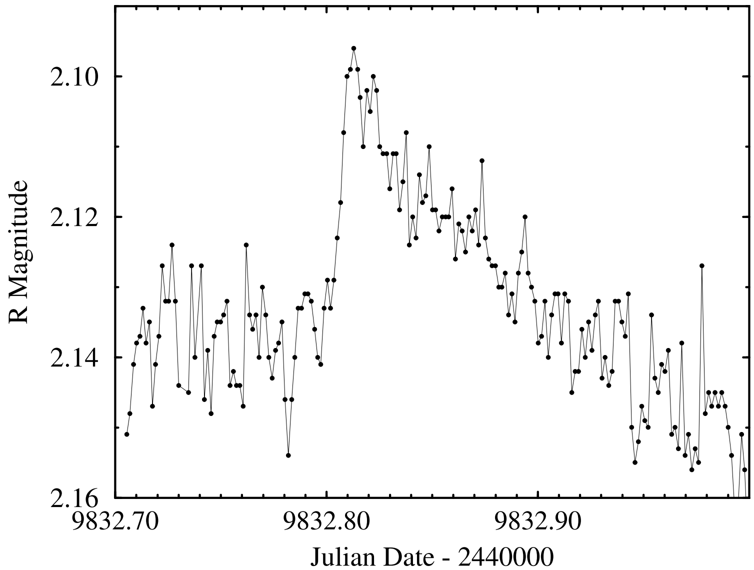

Figure 3. Differential R magnitudes for Julian Date 2449832 showing a flare

Observations on the Julian Date 2449832 are plotted in Figure 3. A large flare occured at approximately 7:30 UT and lasted until 9:30 UT with an amplitude of 0.04 magnitudes. The peak power of the flare is of the same order of magnitude as that of the active star RE0041+342 (Robb 1995), which is one of the largest ever seen.

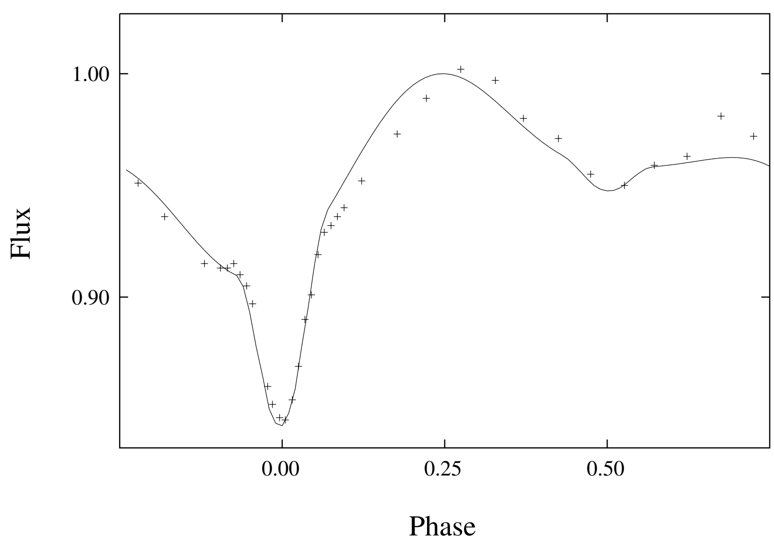

Figure 4. Differential R magnitudes with example model

The light curve modelling program Binmaker 2.0 (Bradstreet 1993) was used to make a light curve which approximates the data as seen in Figure 4. The parameters used are temperatures of 6280 K and 3500 K, and relative polar radii of 0.337 and 0.203 for the hot and cool star respectively. The mass ratio was assumed to be 0.6 and the inclination was 66°. One spot was used which had a co-latitude of 60°, longitude of 300°, radius of 21° and a temperature factor of 0.9. All other inputs were set at values appropriate for these temperatures.

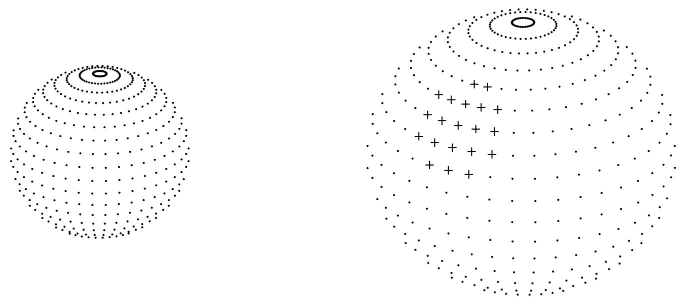

Figure 5. Scale model of the system at phase=0.75

A scale model of the system at phase 0.75 is shown in Figure 5 again produced by Binmaker 2.0 (Bradstreet 1993). The sizes and shapes of the stars are approximately correct for a F7V primary and a K5V secondary star. The size and longitude of the spot are well constrained but the latitude of the spot is arbitrary. A better fit can be obtained by adding more spots, but with less confidence in their properties.

MS 1428.2+0732 is an eclipsing binary star with active regions on its surface causing brightness variations, flares and X-ray emission from an active corona. Further observations will be interesting to increase the precision of the period in order to look for mass transfer and magnetic braking.

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DISCOVERY OF AN ECLIPSING BINARY STAR IN AURIGA

New photoelectric observations of BD +38°1005 (=HD 31992= SAO 57581) have shown that it is an Algol type eclipsing binary star with a period slightly longer than either 1 or 2 days.

A check of the GCVS's updated version (ftp://cdsarc.u-strasbg.fr/cats/II/139B/catalog.Z) and the recent volumes of the Information Bulletin on Variable Stars did not reveal any previously known variable at the position of BD +38°1005.

BD +38°1005 with a spectral type B5 was observed as the check star during the observations of early type eclipsing binary TT Aur. Observations were performed in 3 nights between 6-10 February 1997, and on 28 April 1997 at the National Observatory, by using a SSP-5A photometer attached to a 0.4m Cassegrain telescope.

The reduced U, B, and V differential observations of the check star BD +38°1005 with respect to the comparison star BD +39°1191 show that BD +38°1005 is a detached eclipsing binary (see Figure 1). The constancy of the comparison star (to TT Aur) was shown before (cf. Wachmann, 1985). Only the descending branch of two eclipse minima were observed. The observations with large scatter at the shoulder of the eclipse minimum were made at very large zenith distance. The following preliminary ephemeris has been computed for the future observations:

$$\text{MinI} = \text{HJD}\, 2450488.57 + 2^{\text{d}}\!.02 \times \text{E}$$

or

$$\text{MinI} = \text{HJD}\, 2450488.57 + 1^{\text{d}}\!.01 \times \text{E}$$

This work was supported by The Scientific and Technical Research Council of Turkey. The data have been obtained during the test period of 0.4m telescope of the National Observatory of Turkey (http://astroa.physics.metu.edu.tr/tug/home.html). I thank to Osman Demircan for the encouragement and help at different stages of this work, to Fevzi Çetin and Cahit Yeşilyaprak for their help in observations, and Ümit Kızıloğlu and İlhami Yeğingil for their technical support at the Observatory.

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Reference:

Wachmann, A.A. 1985, *A&AS*, **60**, 349

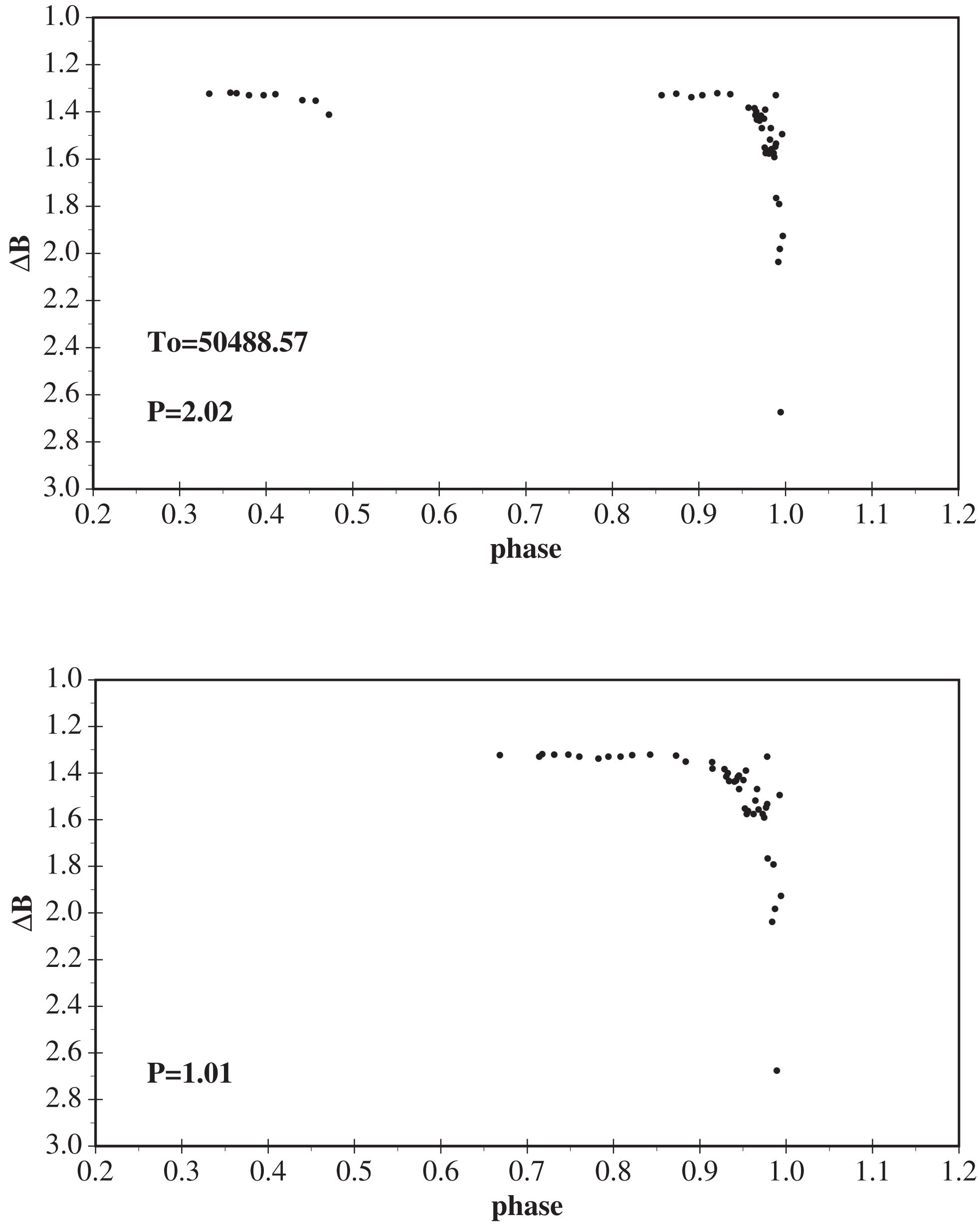

Figure 1. The light curve of BD +38°1005

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IMPROVED POSITIONS FOR SONNEBERG VARIABLES: PART 1

The Sonneberg Observatory is well known in the world for its large plate archive and also for its contribution to the variable stars research field with almost 11000 variables discovered there. However most of these stars have had only approximate positions reported, so the follow-up observations and cross-referencing to other catalogues is sometimes difficult. Because many Sonneberg variables are located on the fields of the PICA project, one independent part of the project is to determine more precise coordinates for these stars. This paper is the first one devoted to the position improvements for Sonneberg variables.

My work on the PICA project significantly speed up after the USNO A1.0 catalogue (Monet *et al.*, 1996) was kindly supplied by D.G. Monet. The identification procedure now used is as follows: the A1.0 catalogue is visualized on computer screen by means of a special program (written by the author) and then compared with the published chart. When any problem appears then Digitized Sky Survey (DSS) provided by STScI (1997) is used in conjunction with Cotton's Fitsview utility (1996), which is also used for position determination of objects present on DSS but not included in A1.0 catalogue. When no object is found neither in A1.0 nor in DSS, then the coordinates are either estimated according to the position marked on chart or preferably measured from direct CCD images (or plate scans).

Table 1 gives precise positions for objects having published finding charts in MVS 246 – 249 (1957). North on these charts is on the top with exceptions marked directly on individual charts. However there are deviations from this rule and these are noted in remarks. Comments from original paper of Hoffmeister (1931) were used when possible. The source of the position is coded as follows : A = A1.0, C = CCD, D = DSS+Fitsview, E = estimate, P = plate scan. Positions should be precise to $\pm 1''$ for A, C, P code and to $\pm 2''$ for D code. The possible error for E code is noted in remarks. Identification with GSC is given where possible. No other identifications were searched for. As on the charts is not every time given final designation (it was not known at the time when charts were published), provisional designation is given in the table too. The differences resulting from a comparison with the positions given in GCVS in the sense $new - GCVS$ are also shown, where $\Delta\alpha$ is given is seconds of time and $\Delta\delta$ is given in minutes of arc.

Table 1

Prov. desig.	Name	RA (2000)	Dec	GSC	s	$\Delta\alpha$	$\Delta\delta$	Remark
121.1931	AT Tau	5 39 55.66	+27 51 05.2	1869.1345	A	+7.8	−0.5	
122.1931	AW Tau	5 47 30.21	+27 08 10.8		A	+2.3	+1.2	
123.1931	AY Tau	5 49 48.80	+25 25 24.1	1866.1969	A	−3.7	+0.6	
124.1931	CG Tau	5 51 58.94	+27 29 21.1		D	−0.6	+0.2	2
125.1931	BB Tau	5 52 18.70	+25 49 41.9	1867.2497	A	−0.4	0.0	
126.1931	BC Tau	5 52 58.85	+24 14 30.5	1863.0151	A	−5.9	+1.9	
127.1931	BD Tau	5 53 41.41	+23 51 43.0	1863.0969	A	−3.9	+0.2	
128.1931	CN Tau	5 58 09.40	+28 02 33.4	1871.2093	A	+3.0	−0.7	
129.1931	CO Tau	5 58 54.64	+26 13 53.6	1867.1913	A	−1.0	+0.7	

Table 1 (continued)

Prov. desig.	Name	RA (2000)	Dec	GSC	s	Δα	Δδ	Remark
130.1931	BF Tau	5 59 47.19	+26 45 30.6	1871.1494	A	+8.7	+0.4	
131.1931	BO Aur	6 00 10.64	+29 14 06.6	1876.0382	A	+0.5	0.0	
132.1931	BF Gem	6 01 54.99	+26 19 41.3	1872.0911	A	+0.2	+1.7	
133.1931	DP Gem	6 02 24.42	+27 24 53.1	1872.1682	A	+1.0	+0.1	
134.1931	BR Aur	6 02 45.95	+29 38 44.9	1876.1947	A	−7.9	−0.2	
135.1931	BB Aur	6 03 25.06	+31 38 40.5	2419.0804	A	+0.1	0.0	
136.1931	BT Aur	6 04 28.71	+29 51 04.9	1876.0980	A	+4.6	+0.3	
137.1931	BS Aur	6 04 17.06	+28 29 01.4		A	−1.0	−0.2	
138.1931	BH Gem	6 04 39.18	+26 25 17.5	1872.1061	A	−3.8	+0.5	
139.1931	BV Aur	6 10 54.71	+30 13 51.6	2420.0581	A	−7.0	+0.5	
140.1931	CQ Mon	6 27 14.00	+4 46 31.2	0141.1493	A	−1.4	−0.6	
141.1931	CE Mon	6 46 57.40	+3 03 26.5	0152.2294	A	+1.1	−0.3	
142.1931	DI Mon	6 49 36.26	+3 10 19.5	0152.2191	A	+0.8	+0.2	
143.1931	BU Mon	6 50 33.64	+3 44 16.6	0152.1957	A	−6.4	−0.2	
144.1931	CG Mon	6 51 27.15	+5 13 22.0	0156.1137	A	+1.4	−0.6	
145.1931	DL Mon	6 51 55.46	+5 11 08.3	0156.0693	A	−6.3	−1.2	
146.1931	CL Mon	6 55 36.65	+6 22 44.0	0161.1272	A	+2.6	−0.3	
147.1931	BP Mon	6 56 55.44	+5 01 43.9	0157.1941	A	−1.1	+0.2	
148.1931	DS Mon	6 44 47.46	−5 17 48.9	4807.2754	A	+3.7	−1.7	
149.1931	V512 Mon	6 47 31.88	−4 42 59.0	4808.2174	A	+6.5	+1.4	
150.1931	DX Mon	6 47 57.50	−2 07 25.0	4804.1809	A	+1.1	0.0	
151.1931	DZ Mon	6 49 56.33	−4 49 37.9	4808.1020	A	+6.0	+0.9	
152.1931	EH Mon	6 52 08.71	−7 03 52.8	4812.0943	A	−7.0	−0.2	
153.1931	EI Mon	6 52 27.29	−5 45 51.5	4812.0516	A	+3.0	−0.2	
154.1931	EK Mon	6 52 46.13	−2 27 30.0	4805.0467	A	+0.1	−0.1	
155.1931	EM Mon	6 54 54.71	−8 01 18.9	5380.0096	A	−0.9	0.0	
156.1931	EX Mon	7 01 59.12	−8 06 12.8	5381.0523	A	−2.5	+1.2	
157.1931	BQ Mon	7 04 25.76	−9 57 58.3	5385.0039	A	−1.8	−0.4	
158.1931	EZ Mon	7 05 25.36	−5 10 36.8	4822.1190	A	−0.6	+1.0	
159.1931	FF Mon	7 06 35.51	−3 21 20.5	4818.2450	A	−3.5	+1.4	
160.1931	BR Mon	7 07 22.39	−1 19 25.3	4814.0434	A	0.0	−0.7	
161.1931	FI Mon	7 10 37.99	−7 07 22.0	4827.1039	A	−7.9	+0.6	
162.1931	BW Mon	7 11 22.22	−1 29 40.2	4815.1732	A	−5.9	+0.4	
163.1931	FK Mon	7 11 21.15	−5 27 08.4		A	−4.6	+0.9	3
164.1931	FP Mon	7 15 08.83	−9 57 47.8	5398.1061	A	−0.9	−0.5	
165.1931	FR Mon	7 17 48.28	−9 38 10.3	5399.0783	A	−1.8	+1.3	
166.1931	DZ CMa	7 16 59.31	−15 18 26.3	5965.0667	A	+6.8	+1.0	
167.1931	DR CMa	7 22 24.09	−15 19 32.7	5966.0512	A	−1.6	+0.3	
168.1931	DS CMa	7 24 09.71	−15 14 55.0		A	+1.9	+1.0	
169.1931	HN Pup	7 29 46.02	−15 22 11.5	5979.2826	A	−2.8	−0.9	
170.1931	KP Mon	7 30 06.80	−10 53 21.5	5400.0633	A	−0.1	0.0	
171.1931	EE Pup	7 30 28.20	−14 44 34.7		A	+5.6	+1.0	
172.1931	FV Pup	7 32 36.37	−12 14 15.5	5405.2616	A	−4.1	−0.8	
173.1931	FX Pup	7 33 02.06	−11 47 55.5	5405.2443	A	+2.0	−1.4	
174.1931	HO Pup	7 33 54.13	−15 45 38.3		A	+0.6	+0.9	
175.1931	NSV 03651	7 35 06.98	−15 08 03.7	5979.2750	A	+5.7	+0.6	
176.1931	BF Pup	7 35 25.17	−15 06 33.0	5979.2390	A	−1.1	+0.3	4
177.1931	FZ Pup	7 38 06.87	−17 37 22.2	5984.2694	A	+2.4	+0.5	
178.1931	GH Pup	7 39 37.56	−15 56 20.2	5980.2323	A	+56.1	+0.6	5
179.1931	GK Pup	7 41 44.01	−15 13 50.1	5980.1982	A	−9.4	−0.7	
180.1931	GN Pup	7 46 35.78	−15 00 33.3	5981.1169	A	0.0	0.0	6
181.1931	GO Pup	7 47 37.49	−11 57 11.1	5419.2392	A	+0.3	0.0	
182.1931	GQ Pup	7 48 29.06	−16 23 12.5	5981.0576	A	−0.2	+1.3	
183.1931	EG Her	17 39 26.52	+29 17 34.1	2088.1619	A	+1.0	+0.1	7
184.1931	NR Her	17 40 30.64	+27 50 57.6	2084.1066	A	−2.0	+0.4	
185.1931	LW Her	17 41 48.91	+25 09 25.6	2080.1960	A	+0.4	+0.1	
186.1931	FS Her	17 44 13.90	+25 14 55.0	2081.0972	A	+3.5	+0.1	
187.1931	LY Her	17 45 09.65	+25 20 12.8	2081.2430	A	−0.6	−0.3	
188.1931	EH Her	17 45 56.51	+32 51 31.1	2611.1450	A	−0.2	−1.4	
189.1931	EI Her	17 48 20.41	+24 42 27.2	2081.1595	A	−6.7	+0.4	

Table 1 (continued)

Prov. desig.	Name	RA (2000)	Dec	GSC	s	$\Delta\alpha$	$\Delta\delta$	Remark
190.1931	EK Her	17 49 17.69	+24 59 08.2	2081.3600	A	−12.0	0.0	
191.1931	LZ Her	17 49 29.23	+29 19 15.8	2089.1510	A	−2.1	+1.1	
192.1931	EL Her	17 51 48.58	+26 38 48.6	2098.2583	A	−5.8	+0.5	8
193.1931	EN Her	17 53 38.57	+26 39 25.7	2098.2793	A	−3.8	+2.0	
194.1931	EO Her	17 53 55.88	+28 13 25.6	2102.0068	A	−0.1	+0.9	
195.1931	FT Her	17 54 04.61	+28 57 49.1	2102.2426	A	−10.3	+2.3	
196.1931	EP Her	17 55 09.40	+26 36 19.1	2098.2384	A	+3.0	+2.7	
197.1931	ER Her	17 56 48.29	+25 54 21.5	2094.3319	A	+3.9	+1.7	
198.1931	ES Her	17 56 42.45	+32 52 31.8	2612.0362	A	−7.1	−2.2	
199.1931	EU Her	17 58 13.45	+31 55 10.0	2612.1609	A	−6.7	−1.6	
200.1931	FW Her	17 59 25.79	+25 43 12.6	2094.1197	A	+5.2	−1.7	
201.1931	EV Her	17 59 03.51	+31 41 57.6	2608.1902	A	−5.1	+0.1	
202.1931	MN Her	18 02 17.64	+27 53 27.9	2099.1300	A	−2.8	−1.6	
203.1931	EW Her	18 03 50.52	+33 23 01.5		A	−4.2	−2.2	1
204.1931	EY Her	18 04 38.79	+32 41 39.7	2625.0721	A	−3.2	−0.6	
205.1931	EZ Her	18 04 56.61	+28 32 46.8	2103.0130	A	−9.9	+0.5	
206.1931	FF Her	18 05 07.50	+30 05 41.0	2621.0282	A	−6.7	+2.4	9
207.1931	FY Her	18 06 28.56	+29 05 50.9	2103.3029	A	−3.1	−0.6	10
208.1931	FH Her	18 06 09.24	+32 22 13.0	2625.0277	A	−9.3	+0.8	
209.1931	FI Her	18 09 54.82	+31 21 46.1		A	−3.3	+0.1	
Ross 297	CG Her	18 11 41.20	+26 25 56.6		A	+0.5	+0.2	
210.1931	V555 Oph	17 42 14.33	+5 23 57.7	0423.0716	A	+1.8	0.0	11
211.1931	NSV 09582	17 43 20.41	+5 09 16.3	0423.1094	A	+6.6	−0.4	11
212.1931	V 439 Oph	17 43 33.28	+3 35 36.2	0419.1720	A	+4.7	−0.6	
213.1931	V557 Oph	17 45 04.73	+6 41 37.7		A	+0.7	0.0	
214.1931	V457 Oph	17 47 14.08	+3 04 38.3	0420.0040	A	−1.1	−0.1	
215.1931	V559 Oph	17 47 12.73	+3 20 21.5	0420.1303	A	−0.2	−0.1	
216.1931	V458 Oph	17 47 37.13	+1 32 36.7	0416.0618	A	−0.9	−0.2	
217.1931	V560 Oph	17 48 52.66	−1 13 53.2	5082.1714	A	+6.4	+1.0	
218.1931	V459 Oph	17 48 47.15	+1 59 46.7		A	+0.7	+0.1	
219.1931	V562 Oph	17 49 00.42	+2 38 27.3	0420.0119	A	+7.7	−0.6	
220.1931	V460 Oph	17 49 24.74	−0 03 06.6		A	+0.9	+0.5	
221.1931	V563 Oph	17 49 29.29	+3 19 22.7		A	−1.6	−0.2	
222.1931	V461 Oph	17 51 15.59	+0 43 23.5	0416.1852	A	−0.4	0.0	
223.1931	V462 Oph	17 51 08.63	+2 51 07.1		A	+0.1	+0.1	
224.1931	V463 Oph	17 51 37.92	−1 32 21.8		A	+3.3	+0.3	
225.1931	V464 Oph	17 51 42.16	+5 05 26.7	0424.0637	A	−0.7	+0.1	
226.1931	V465 Oph	17 52 07.42	−1 05 07.8	5082.1262	A	+3.4	−0.6	
227.1931	V530 Oph	17 52 02.73	+4 37 25.7	0424.1475	A	+0.3	+0.3	
228.1931	V466 Oph	17 52 07.23	+4 52 43.9	0424.1174	A	−0.9	+1.2	
229.1931	V467 Oph	17 53 16.92	−0 28 08.1		A	+8.5	+1.5	
230.1931	V468 Oph	17 54 02.02	+6 18 45.2	0429.1968	A	+2.6	+0.1	
231.1931	V469 Oph	17 54 43.01	+0 47 15.2	0417.0655	A	+0.1	+0.1	
232.1931	V470 Oph	17 54 40.06	+0 56 08.7	0417.0361	A	+0.3	0.0	
233.1931	V531 Oph	17 54 40.88	+6 10 34.1	0429.1462	A	+1.3	0.0	
234.1931	NSV 09850	17 55 03.32	+1 15 29.2	0417.0590	A	−1.1	+0.9	
235.1931	NSV 09851	17 55 01.66	+3 21 20.2	0421.0847	A	−1.3	+0.8	1
236.1931	V471 Oph	17 55 28.71	+2 18 30.2		A	−0.4	+0.1	
237.1931	V472 Oph	17 55 47.12	+0 56 37.8	0417.1923	A	+0.4	+0.2	
238.1931	V565 Oph	17 55 42.26	+5 52 10.0		A	+0.3	+0.2	
239.1931	NSV 09878	17 56 20.96	+3 23 30.8	0421.0226	A	−0.9	−0.2	
241.1931	V473 Oph	17 56 53.13	+3 22 11.9	0421.0376	A	−0.8	+0.1	
54.1907	SV Oph	17 56 24.80	+3 22 38.1	0421.0854	A	−0.1	0.0	
240.1931	NSV 09881	17 56 25.66	+0 36 19.2	0417.2172	A	−4.5	+2.7	
242.1931	V474 Oph	17 57 55.70	+0 58 22.1	0417.2557	A	+1.0	−0.1	
243.1931	V1013 Oph	17 57 58.59	+5 34 36.2		A	+4.3	+1.8	
244.1931	V475 Oph	17 58 24.74	+4 09 05.5		A	+0.8	+0.2	
245.1931	V476 Oph	17 58 22.58	+3 37 18.2	0421.0335	A	+1.0	−0.1	
246.1931	V477 Oph	17 59 08.15	+5 38 25.7		A	+0.9	+0.1	
247.1931	V478 Oph	17 59 38.97	+0 47 08.4	0417.2031	A	+0.1	−0.1	

Table 1 (continued)

Prov. desig.	Name	RA (2000)	Dec	GSC	s	Δα	Δδ	Remark
248.1931	V479 Oph	18 00 04.11	+6 07 16.5	0442.1093	A	−1.6	+1.3	
249.1931	V 480 Oph	18 00 32.43	+1 08 51.8	0430.3557	A	−8.1	−0.1	
250.1931	V481 Oph	18 00 54.49	+2 19 37.3	0434.3668	A	−1.6	−0.4	
251.1931	NSV 09981	18 01 04.41	+1 29 25.2	0430.2390	A	+0.3	+1.4	
252.1931	V482 Oph	18 01 07.02	+0 41 43.9	0430.2105	A	+2.0	−0.1	
253.1931	V483 Oph	18 01 19.58	+2 58 01.6	0434.2819	A	+10.2	0.0	
254.1931	V570 Oph	18 01 22.77	+4 02 28.6	0438.2164	A	−0.3	+0.2	
255.1931	V485 Oph	18 02 12.49	+5 02 50.4	0438.1803	A	−0.4	+0.3	
256.1931	AX Ser	18 02 30.90	−0 05 59.5	5096.0029	A	−1.0	−0.1	
257.1931	V484 Oph	18 02 06.81	+7 03 33.0	0442.1130	A	−1.7	−0.5	
258.1931	V487 Oph	18 02 33.66	+1 47 47.5	0430.1536	A	−0.1	+0.7	
259.1931	V486 Oph	18 02 27.52	+4 28 01.4	0438.1446	A	+7.0	−2.1	
260.1931	V488 Oph	18 02 46.94	+4 18 10.3	0438.1826	A	+7.2	−0.9	
261.1931	V489 Oph	18 03 01.89	+4 58 46.2		A	+5.9	−0.4	
262.1931	V490 Oph	18 03 33.03	+4 28 32.3	0438.2002	A	+0.5	−1.6	
263.1931	V491 Oph	18 04 31.36	+3 23 52.0	0434.1058	A	−1.5	−1.4	
264.1931	V492 Oph	18 05 23.80	+2 56 35.7	0434.0921	A	+2.4	+0.3	
265.1931	V493 Oph	18 06 58.78	+5 31 46.2	0438.0161	A	−1.6	+0.3	
266.1931	AY Ser	18 08 06.58	−0 15 17.4		A	−2.6	+1.2	
29.1926	V426 Oph	18 07 51.71	+5 51 49.7	0443.1459	A	−0.3	−0.1	

Remarks:

1. Two entries for the same star in A1.0. The position given in the table is an average.
2. **CG Tau** – mean position of a close double, not known which component varies.
3. **FK Mon** – north on the bottom.
4. **BF Pup** – not sure, northernmost in a small triangle.
5. **GH Pup** – GCVS position in error by 1^m.
6. **GN Pup** – southern component of a double star; the northern one is GSC 5981.1307 at a distance of about $7''$.
7. **EG Her** – north to the right side.
8. **EL Her** – nearby GSC 2098.2252 represents another object about $15''$ to east. On DSS it seems that these two objects are connected with some nebulosity. There also exist GSC 2098.3223 which is probably EL Her in maximum and blended with its eastern neighbour.
9. **FF Her** – north on the bottom.
10. **FY Her** – north to the right side, not left.
11. **V555 Oph** and **NSV 09582** – two independent charts in one frame. Should be vertically divided into two square frames.

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ECLIPSE OBSERVATIONS OF AB ANDROMEDAE

AB Andromedae (G5+G5V, R=8.95, $23^h11^m31^s.90$, $+36°53'35''.7$, (J2000) is a frequently observed close eclipsing binary. This system is on the AAVSO list of eclipsing binaries (Baldwin and Samolyk 1993). The AAVSO bulletin reports eclipse minimum observations made between the dates JD 2442909.879 and 2448835.813. An O−C plot of the AAVSO observations shows the published period of 0.33189215 days is decreasing with time.

The present note describes CCD photometry of AB And from the University of Iowa Automated Telescope Facility located in Iowa City, Iowa. The system consists of an 18cm refractor, a Spectrasource HPC-1 CCD camera (format 512×512 binned pixels, $3''.00$ per pixel), and a Johnson *R*-band filter. We used the nearby Guide Star Catalog (GSC) stars GSC 2763.484 [$23^h12^m14^s$, $+36°58'30''$]; GSC 2763.683 [$23^h11^m14^s$, $+36°51'15''$]; GSC 2763.848 [$23^h11^m01^s$, $+36°58'20''$, (J2000)] as check stars and the nearby star GSC 2764.1629 [$23^h12^m08^s.$, $+36°46'50''$, (J2000)] as the comparison star. A 60 second exposure of a field containing AB And as well as the check and comparison stars was repeated every two minutes for three hours. Differential aperture photometry was performed by an automated procedure after aligning all images to a common stellar reference. No air mass or color corrections were applied. The AB And system was observed during the nights of 29 October 1995 UT and 12 July 1996 UT. Light curves were produced by plotting the data obtained on these nights. These plots are shown in Figure 1.

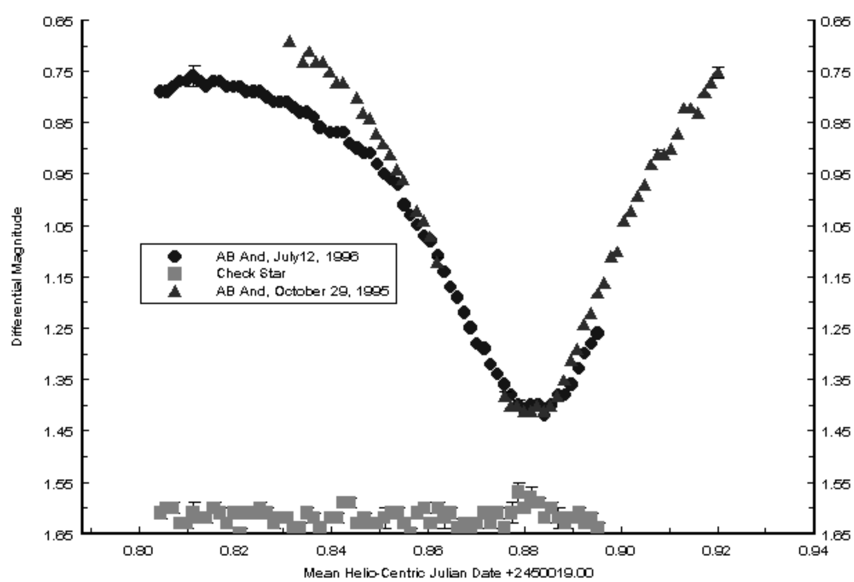

Figure 1. Two light curves for AB And from the nights of October 29, 1995 and July 12, 1996. The primary minimum of October 29 has been superimposed over the secondary minimum of July 12. The abscissa is correct for October 29

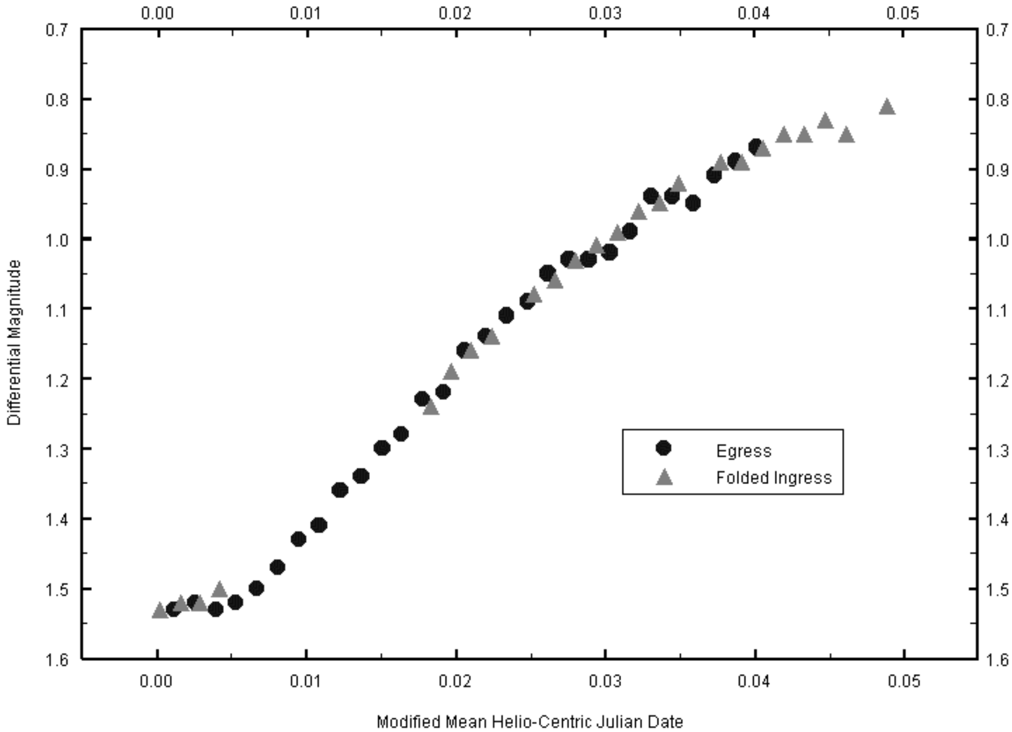

Figure 2. A sample folded light curve. The MHJD of minima has been set to zero and the absolute value of the MHJD has been plotted. The data shown is for October 29 1996 UT

We observed a primary minimum at 2450019.8290±0.0005 Heliocentric Julian Date (HJD) and a secondary minimum at 2450275.8824±0.0005 HJD. The errors in the minima were found by 'folding' the light curves, i.e. setting the HJD at the time of minimum to zero and plotting the differential magnitude versus the absolute value of the modified HJD to produce a folded light curve for each night. As our original curves were almost perfectly symmetric, any shift in the minimum HJD greater than ±0.0005 HJD caused noticeable discrepancies between the two halves. A folded light curve is shown in Figure 2.

The O−C measurements available from the AAVSO compilation clearly show that the linear ephemeris published in the AAVSO bulletin,

$$JD_{min} = 2,436,109.5793 + 0.33189215 \times E$$

where JD_{min} is the time of primary minima, is not precise any longer. Demircan *et al.* (1994) has shown that a sinusoidal function provides a satisfactory fit to the O−C residuals from a linear ephemeris:

$$JD_{min} = JD_0 + 0.3318890 \times E - A_s cos(2\pi \cdot (E - T_s)/P_s)$$

where JD_0 is the reference epoch, A_s is the semi-amplitude in days, T_s is the period in orbital cycles, and P_s is the minimum time in units of E. Numerical values of the parameters are listed in the table.

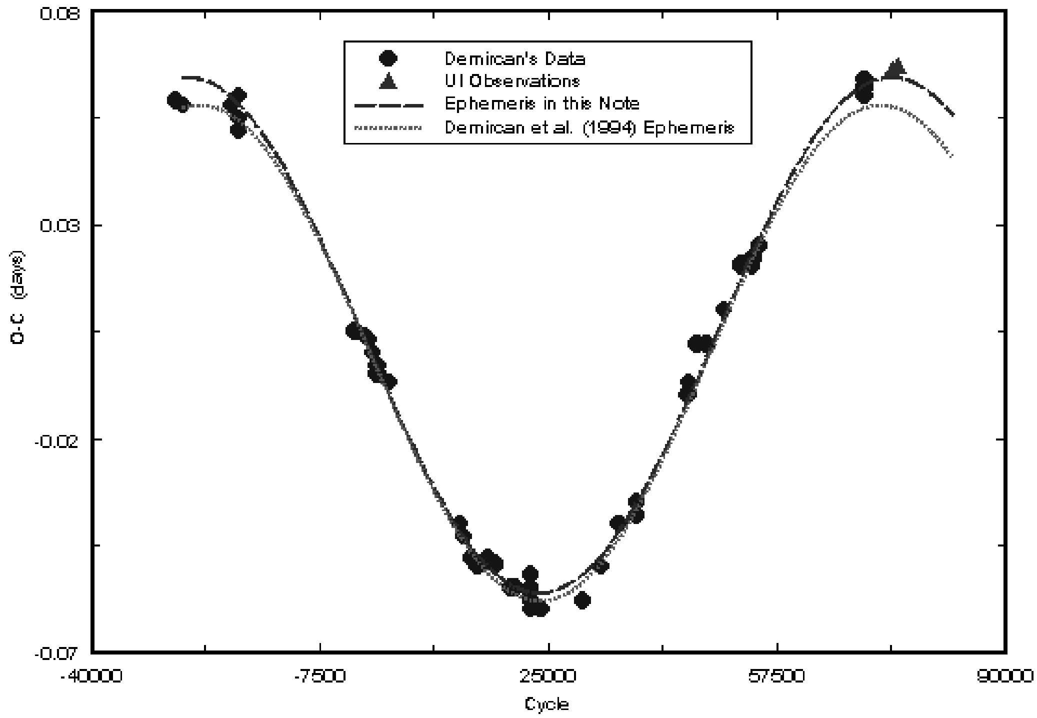

Figure 3. O−C graph of the historical data of Demircan et al. (1994) along with the minima reported in this note. The data has been fitted with Demircan's ephemeris and the ephemeris reported in this note

Our times of minima do not agree with this ephemeris. They are consistent with a phase shift of 0.06 days with respect to Demircan *et al.'s* ephemeris. We have solved for a new periodic ephemeris that fits both his historical data and our data. The table below shows our revisions to Demircan's ephemeris. The change in JD_0 is due to a residual offset required to best fit all data points.

Reference	JD_0	A_s	T_s	P_s
Demircan *et al.* (1994)	2425297.4805	0.0580	23800	96800
Nellermoe and Reitzler (this note)	2425297.4846	0.0603	23707	100230

Figure 3 is a plot of Demircan's data along with the minima reported in this note fitted with the revised ephemeris equation. The fit has a root mean square uncertainty of 0.0028 days.

This sinusoidal trend in the O−C plot suggests the presence of a third-body with a period of approximately 91 years. Demircan *et al.* suggest a similar result, with a third-body period of 88 years.

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Interested parties can obtain the raw photometric data from the authors at the following e-mail address: *atfproj@astro.physics.uiowa.edu.*

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CORRECT POSITION OF MX SAGITTAE

During my work on *PICA project* (Precise Identification and Coordinate Adjustment of about 7000 variables) on stars in the field of *U Sge* I found in 1996 that *MX Sge* cannot be located at its nominal position. Skiff (1997) had also noticed this fact but he was unable to find its correct location. As finding chart was published by Rosino and Guzzi (1978) I was successful after some effort and found that the position reported by Rosino and Guzzi for their star 67 = *MX Sge* exhibits quite large 4° error in declination (print error ?).

Precise position was extracted from Digitized Sky Survey provided by STScI (1997) used in conjunction with Cotton's Fitsview utility (1996), because the star is not in the USNO A1.0 catalogue. The correct position is as follows:

$$\mathrm{RA} = 19^{\mathrm{h}}17^{\mathrm{m}}56\overset{\mathrm{s}}{.}73 \ \mathrm{Decl.} = +15^\circ 47' 18\overset{''}{.}0 \qquad (2000.0)$$

This large declination error has also one important consequence – *MX Sge* is actually situated in Aquila, similarly to *WX Eri* which is in Taurus despite its name.

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FUOR V1057 Cyg - TWO YEARS IN LOCAL MINIMUM

The star V1057 Cyg belongs to a small-number group of eruptive FU Orionis variables or Fuors (Herbig 1977; Hartmann et al. 1993). Since peak light in 1970 the light curve of the Fuor V1057 Cyg exhibits most remarkable and dynamic changes in comparison with more quiescent behavior in post-outburst stage of two other best-studied Fuors FU Ori and V1515 Cyg. Over the period 1970-1994 V1057 Cyg had declined by about of 3.5 mag in B (Figure 1). In contrast, FU Ori and V1515 Cyg have a much slower declining rates. Throughout post-outburst states both FU Ori and V1515 Cyg have faded by 1.1 (1937-1994) and 0.3 mag (1974-1994) in B, respectively. Moreover, in 1995 V1057 Cyg had suddenly dimmed by 0.8 mag in B (Ibrahimov 1996). Note that the 1995 drop in magnitude of V1057 Cyg is similar to the 1980 one of V1515 Cyg. In 1996 the observations of V1057 Cyg were continued at Mt. Maydanak observatory. These observations have been obtained using the same equipment as described in Ibrahimov (1996). These new observations are combined with existing ones and used to construct the figures. Figure 1 shows historical pg/B light curve of the Fuor based on all available data which have been compiled by the authors and joined with Mt. Maydanak database. Figure 2 shows a more detailed V-light curve of the Fuor based on our own observations in 1995-96. Figure 3 shows the brightness and color variations of the Fuor in 1978, 1981-96 based only on Mt. Maydanak observations.

The figures allow to conclude that the Fuor still remains in local minimum. The observations of 1995-96 (Figure 2) show that the star has no visible trend neither to increase nor to following decrease its brightness. Besides, Figures 2 and 3 indicate the presence of a gradual increase in the amplitude of light variations from 0.2V in 1981-91 to 0.5V in 1996. The similar increases in the amplitudes of light variations are observed in U, B, and R too. Since mid-eighties to 1996 the amplitudes have increased from 0.5 to 0.8 in U, from 0.2 to 0.6 in B, and from 0.1 to 0.3 mag in R.

The evolution of the colors of the Fuor in 1978-96 is most interesting (Figure 3). Despite the continuation of smoothed large-scale fading till 1986, the colors had practically constant values in 1978-86 (cf. the Table in Ibrahimov 1996). During the next five years 1986-90 the light curve shows a slight bowl-shaped increase in the brightness. This increasing light is accompanied by monotonic decrease of the average value of the $U-B$ color from +1.15 to +1.03 mag. At the same time the other two colors did not change. Thus, both colors have remained practically constant during 1978-90: $B-V = +1.76$ and $V-R = +1.59$ mag. During 1991-94 the light curve of the star exhibited saw-tooth variations. These variations are out of phase with similar saw-tooth color variations: i.e., redder colors correspond to higher brightness and vice versa. The 1995 drop in magnitude of V1057 Cyg has led to common reddening by 0.2-0.3 mag of all three colors of the star.

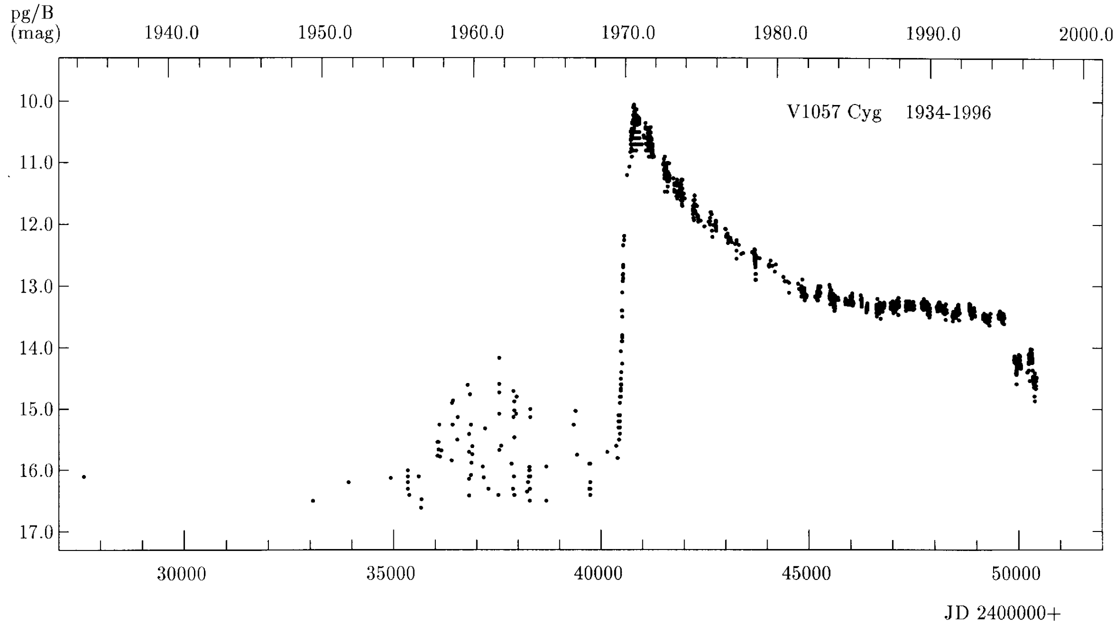

Figure 1. Historical pg/B light curve of V1057 Cyg in 1934-1996

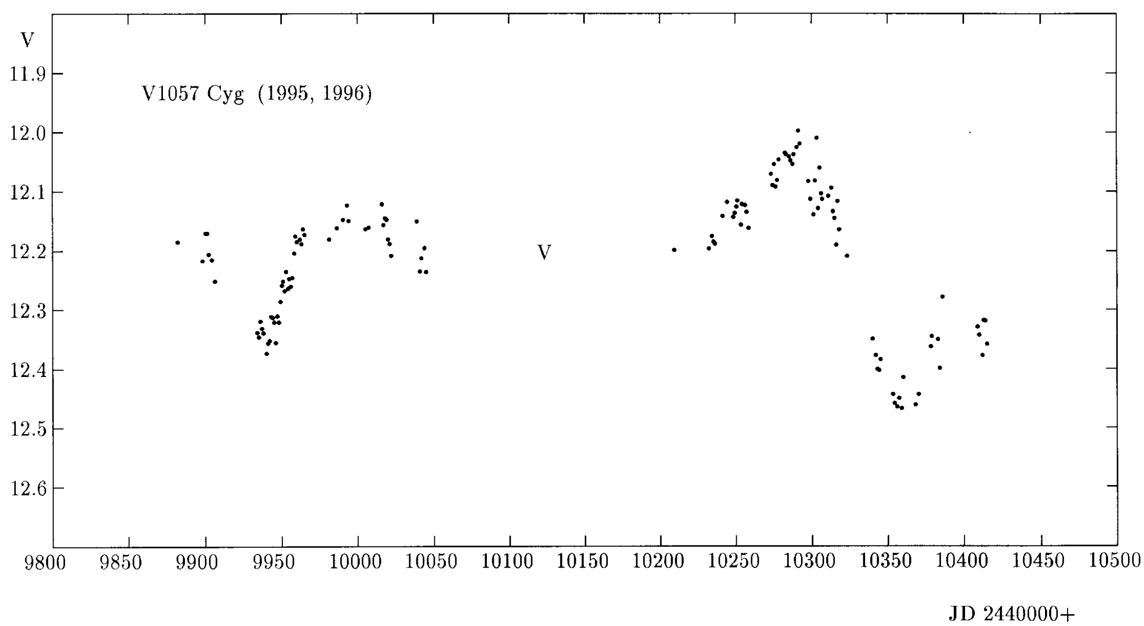

Figure 2. Detail V-light curve of V1057 Cyg in 1995-1996

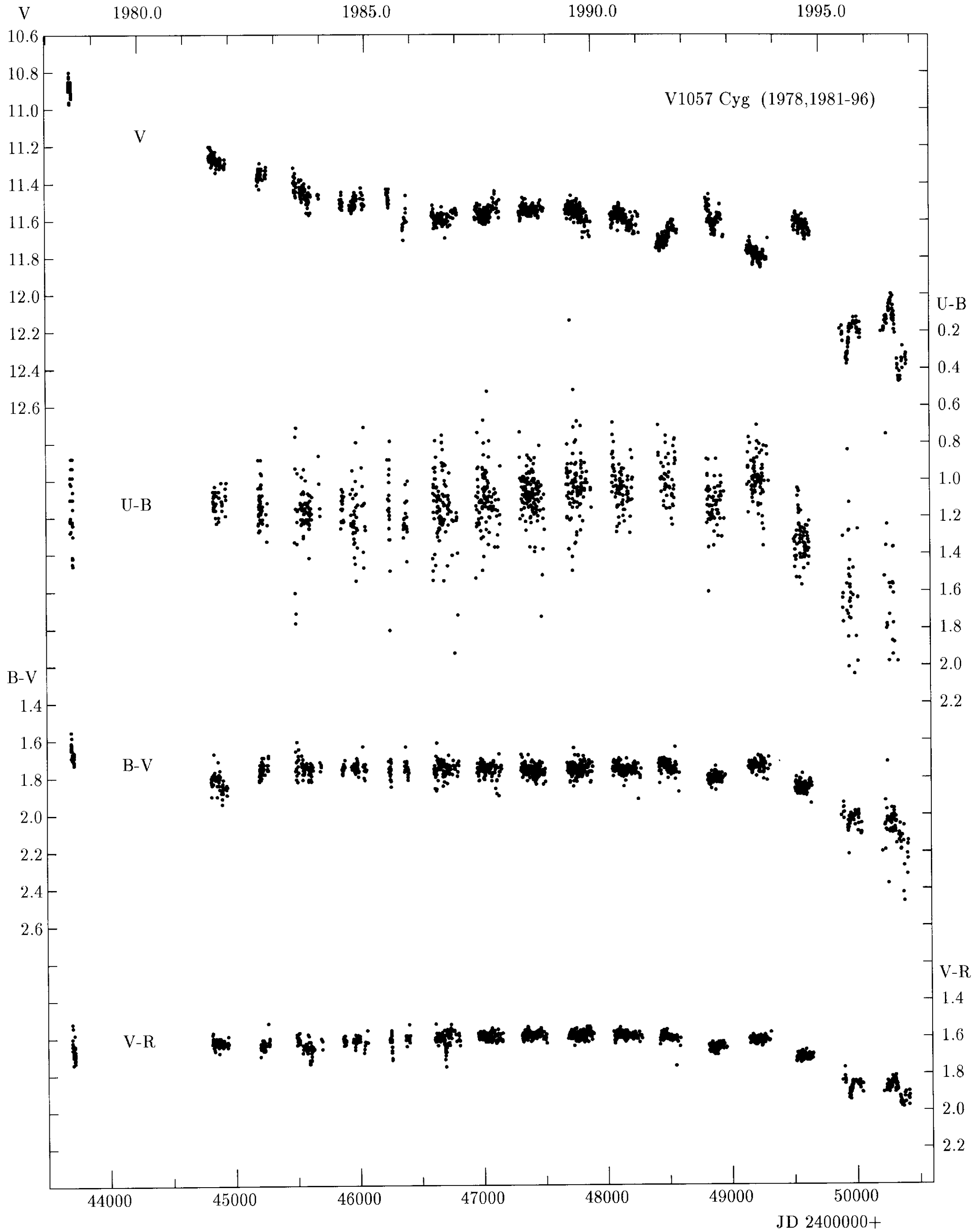

Figure 3. Brightness and color variations of V1057 Cyg in 1978-1996

Now it can be defined that during the decade since mid-eighties to 1996 the general changes of the colors are about of 0.5 mag for U−B and about of 0.3 mag for both B−V and V−R.

Thus, we conclude that the new active phase of photometric changes of the Fuor V1057 Cyg began in 1991. The detected increase in the amplitude of light variations since 1991, remarkable behavior of the colors and the 1995 drop in magnitude of V1057 Cyg provide strong support to the conclusion. The mentioned changes (except the 1980 drop in magnitude of V1515 Cyg) have no analogies in the photometric behavior of the other Fuors. New observations of the Fuor in this active and interesting state are very important and useful.

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ALDEBARAN: DISCOVERY OF SMALL AMPLITUDE LIGHT VARIATIONS

Aldebaran (Alpha Tau = HD 29139) is one of the nearest and brightest red giant stars. It is a standard spectroscopic star with a spectral type of K5 III; its average visual magnitude is about +0.87 mag with mean values of B−V = +1.52 and U−B = +0.90. Aldebaran has a relatively well determined parallax of 0.048 ± 0.005 arcseconds that should improve after the Hipparcos parallax is published. The star also has relatively high space motions with respect to the sun, indicating that it is an old, evolved disk star.

Because of its brightness and accessibility from both ground-based and orbiting observatories, it has been a favorite target of numerous studies. It is listed in the Bright Star Catalog (Hoffleit, 1982) and SIMBAD as a variable star and Petit (1982) classifies it as an Lb-type irregular star. In the literature the visual magnitude range is from $V \cong +0.78$ to +0.93; most of these visual magnitude measurements are from surveys. It should be noted that reported variability for bright stars such as Aldebaran can sometimes have systematic errors due to saturation effects of the detectors and the lack of nearby appropriate comparison and check stars. Hence some of the early visual magnitude values of Aldebaran should be treated with caution.

The only concerted photometric study of Aldebaran was done by Krisciunas (1992). He obtained V-band photometry over 3 observing seasons (1987/88, 1990/91, and 1991/92). However, the photometry was conducted only 4 to 5 nights per season and a total of only 13 nights of data were obtained. Krisciunas found no indication of variability of greater than 0.02 magnitude, and reported Aldebaran to be "essentially constant" within the precision of his measurements. He found mean values of $\langle V \rangle = +0.876 \pm 0.004$ magnitude and $\langle B-V \rangle = +1.549 \pm 0.026$ magnitude. The study of Krisciunas does not support the relatively large ≈ 0.1 light variations reported in the survey data, but there is not sufficient coverage or precision to discern low amplitude brightness changes. To understand and better quantify the photometric behavior of Aldebaran, we undertook a more intensive program of differential photometry of this famous, bright star.

In August 1996, Aldebaran was added to the program of photometry of cool giants and supergiants being carried out by us at Wasatonic Observatory and Villanova University Observatory. The photometry reported here was conducted from August 1996 to March 1997 at the Wasatonic Observatory (Allentown, Pennsylvania) on 31 nights using an uncooled Optec photometer attached to a 20-cm Schmidt-Cassegrain telescope. The detector employed was a silicon PIN-photodiode. Differential photometry was conducted primarily with the V-band but on several nights the star was also observed with the Wing near-IR three filter intermediate band system to measure TiO (Wing, 1992). The characteristics of the Wing three-color system are given in Table 1. The TiO index is calculated according to Wing from:

$$\text{TiO-Index} = A-B-0.13\times(B-C)$$

Table 1. The Wing filter system

Filter	Region Measured	Central Wavelength	Bandpass (FWHM)	Measurements
A	TiOγ(0,0) Band	7190 A	110 A	TiO-Index
B	IR Continuum	7540 A	110 A	B-C Color Index
C	IR Continuum	10400 A	420 A	B-C Color Index

Table 2. Photometric data

JD 2450+	Visual magnitude
324.847	+0.871
356.800	+0.868
365.881	+0.877
380.850	+0.882
402.630	+0.870
418.649	+0.872
426.553	+0.867
438.583	+0.865
455.605	+0.877
470.526	+0.882
477.658	+0.880
483.546	+0.877
504.549	+0.873
517.591	+0.875
531.520	+0.876

where A, B, and C are standardized magnitudes measured with these filters A near-IR color index is also formed from these observations, and is useful for determining the temperature of cool stars. This color index is defined as:

$$\text{IR Color Index} = \text{B}-\text{C}$$

where B and C are the magnitudes measured at 7540 A and 10,400 A, respectively, which are regions clear of molecular absorption.

The comparison star was ϵ Tau (HD 28305; V = 3.50, B$-$V = 1.04, G9.5 III), which is itself a wing IR standard star, and the check star used was π Tau (HD 28100; V = 4.69, B$-$V = 0.98, G7 IIIa). Three ten-second integrations were made for each observation using the usual sky-comparison-variable-comparison-sky sequence. Atmospheric extinction and conversion to heliocentric Julian Day number was done during data reduction. Corrections for the V-band observations to the standard UBV system was also done; IR magnitudes were standardized using magnitude values supplied by Wing (1979).

Nightly and weekly means were computed from the V-data and these are plotted against heliocentric Julian Day in Figure 1, and tabulated in Table 2. As can be seen, the light variations observed over the 6-month period are relatively small. Systematic trends in the data and spline-fits were applied to see if any regularities in the light variations could be found. As shown in Figure 1, Aldebaran appears to vary on a time-scale of about 85-95 days; the full light variation is 0.018 magnitude. To check this period analytically,

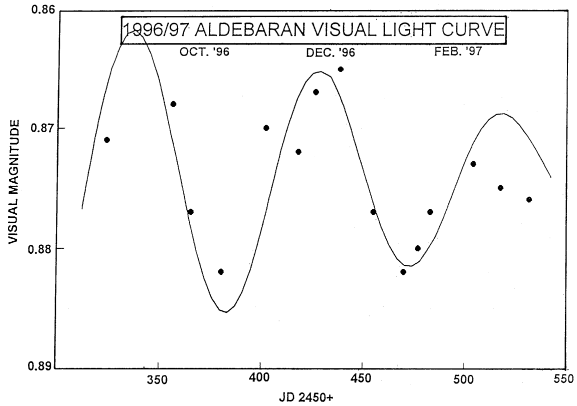

Figure 1. Aldebaran visual light curve; calendar dates are mid-month. The sine curve shown was generated using a 92-day period and varying semiamplitude

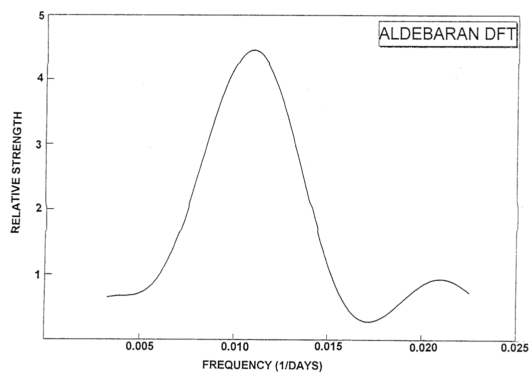

Figure 2. Aldebaran DFT; note peak intensity at frequency 0.01095 (period=91.3 days)

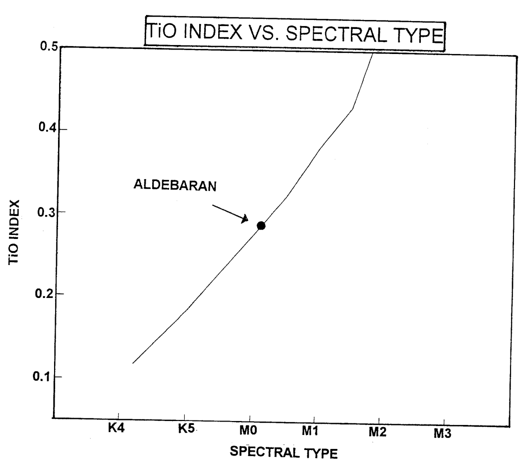

Figure 3. TiO-index - spectral type calibration, indicating Aldebaran as an M0 star

the observations were subjected to a formal period search using a Discrete Fourier Transform (DFT) of Sinnot (1988). Figure 2 shows the results of the DFT; a peak frequency of 0.01095/days was found, corresponding to an approximate 92 day period. This period is close to the photometric period found by inspection. A sine curve of decreasing semi-amplitude, from $0^{\mathrm{m}}.005$ to $0^{\mathrm{m}}.0015$, was generated using the 92-day period. This fit is shown in Figure 1. The agreement with the observations is reasonably good.

It is not certain if this period is stable with time and if there are any long-term changes in brightness. The mean brightness observed by us of $\langle V \rangle = +0.873$ magnitude is in good agreement with the $\langle V \rangle$ found earlier by Krisciunas; this indicates that the star does not have significant long-term brightness changes over the time scale of at least several years.

Based on the apparent observed period and varying amplitude, it appears that Aldebaran has photometric characteristics similar to the so-called Small Amplitude Red Variables (SARVs). SARVs are M-giants which pulsate with small light amplitudes and have periods of up to 200 days and visual amplitudes of up to 2.5 magnitudes (Percy, 1989). If so classified, Aldebaran would have the smallest observed amplitude of this class of stars.

Although we did not attempt to obtain light curves using the Wing IR filters, we did observe the star on four nights with this filter set. From these observations we determined the TiO-index and the near-IR color index to be $+0.282 \pm 0.012$ and -0.227 ± 0.009 magnitude, respectively. From over 20 cool standard stars observed with the Wing filters (Wing, 1978) a TiO-index vs. spectral type was calibrated for K and M-type stars. Part of this calibration is seen in Figure 3, where Aldebaran's TiO-index indicates it is of spectral type M0-III, which is not the usual K5 III value associated with this star. Additionally the U$-$B and B$-$V colors are more suitable for a M0 III star rather than a K5 III star.

More observations using the Wing filters are needed to further quantify the spectral type of Aldebaran and also to search for outer atmospheric TiO variations. Continued photometry is also planned to ascertain period stability and amplitude changes.

The authors wish to thank Dr. Emilia Belserene for her assistance in translating the DFT program from BASIC to FORTRAN. We also than Dr. Robert Wing for providing standard star IR data. For this research we utilized the SIMBAD database, operated by CDS, Strasbourg, France. This work was supported in part by NSF grant AST-9315365, which we gratefully acknowledge.

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NEW ELEMENTS OF V694 AQUILAE

[BAV Mitteilungen Nr. 97]

V694 Aql = 92.1940 Aql = GSC 1058.32 was discovered by Hoffmeister (1940) on photographic plates of the Sonneberg Observatory. He classified the star as an Algol-type variable in the range between $12^{\mathrm{m}}.0$ and $12^{\mathrm{m}}.5$.

First investigation of this variable was performed by Rohlfs (1949). She published 25 minima (times for plates with weak images), a photographic normal light-curve and first elements:

$$\mathrm{Min\ I} = \mathrm{HJD}\quad 2428782.334\ +\ 0^{\mathrm{d}}.450175 \times \mathrm{E} \tag{1}$$

The range of brightness is given as $12^{\mathrm{m}}.4$ - $12^{\mathrm{m}}.9$ (phot.). From her measurements she derived a time of constant light in the minimum of $1^{\mathrm{h}}.4$. With these data V694 Aql is listed in the fourth edition of the GCVS (Kholopov et al. 1985).

Popper (1956) and Wood (1963) pointed out that V694 Aql is of special interest because of its, for an Algol type variable, extreme short period of $0^{\mathrm{d}}.45$. Popper gives for the primary component a radius of $0.3\mathrm{R}_{\odot}$, spectral class F0 and the radial velocities from two spectrograms. Based on the period given by Rohlfs, Brancewicz and Dworak (1980) published additional geometrical and physical parameters.

Almost 50 years later we put V694 Aql on our observing program. The CCD observations were made with SBIG ST6 cameras without filters, attached to a 32cm RC telescope with f = 1740 mm (WM), a 20cm SC telescope with f= 1200 mm (WK) and a 10cm Aero-Ektar astrograph with f = 600 mm (PF). The integration times were 60 seconds at the RC/SC–telescopes and 90 seconds at the astrograph. Our CCD observations cover 3 years. GSC 1058.1442 served as the comparison star and several other stars in the same field were used to check its constancy. In our instrumental system (Aero Ektar) the amplitude of variability is $0^{\mathrm{m}}.50$ for the primary minima and $0^{\mathrm{m}}.15$ for the secondary minima. A constant phase in minimum light could not be detected. All our CCD measured times of minimum light were calculated with the Kwee and van Woerden (1956) method. A thorough study of our measurements showed that the period given in the GCVS is a spurious one with the relation:

$$\frac{1}{\mathrm{P_{GCVS}}} - \frac{1}{\mathrm{P}} = \frac{1}{1\mathrm{d_{sid}}} \tag{2}$$

Using only CCD measured minima a weighted least squares fit led to the new ephemeris:

$$\mathrm{Min\ I} = \mathrm{HJD}\quad \underset{\pm 2}{2450281.5621}\ +\ \underset{\pm 5}{0^{\mathrm{d}}.8205762} \times \mathrm{E} \tag{3}$$

One of us (WM) investigated the variable on about 300 photographic plates of the 0.4m astrographs of the Sonneberg Observatory. 12 additional times of minimum light of V694 Aql could be found. The plates taken between JD 2442000 and JD 2448000 were of first quality. The scatter of the results is therefore small. The gap between JD 2432000 and JD 2442000 could not be closed due to a lack of useful plates from that time. Using all available minima a weighted least squares fit led to the new ephemeris:

$$\begin{array}{rcl} \text{Min I} = \text{HJD} \quad 2450281.563 & + & 0\overset{d}{.}8205795 \times \text{E} \\ \pm 4 & & \pm 4 \end{array} \qquad (4)$$

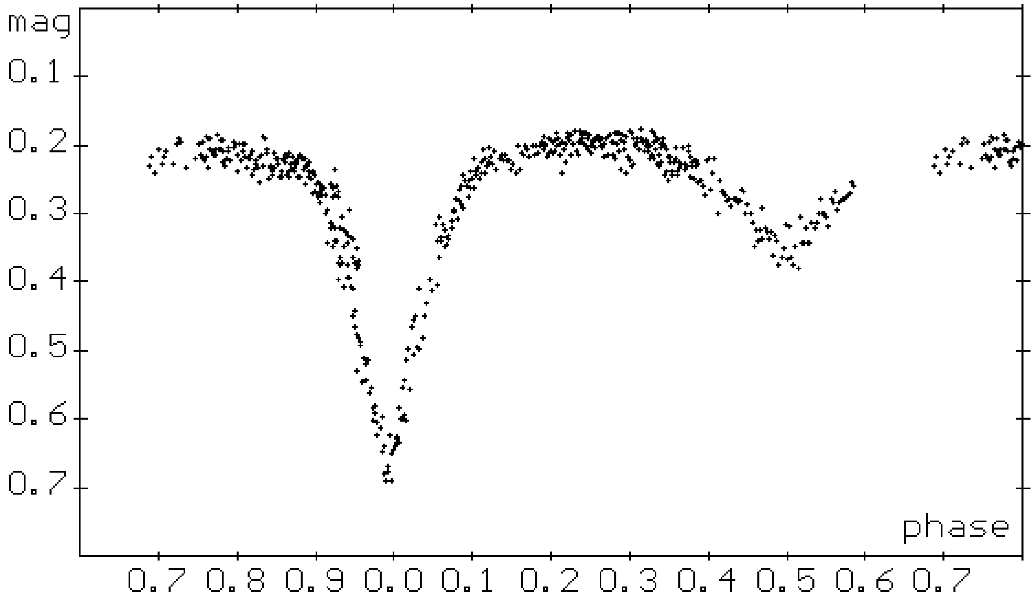

Figure 1. Differential light curve of V694 Aql (Aero-Ektar 100/610 mm) drawn with the new ephemeris (??)

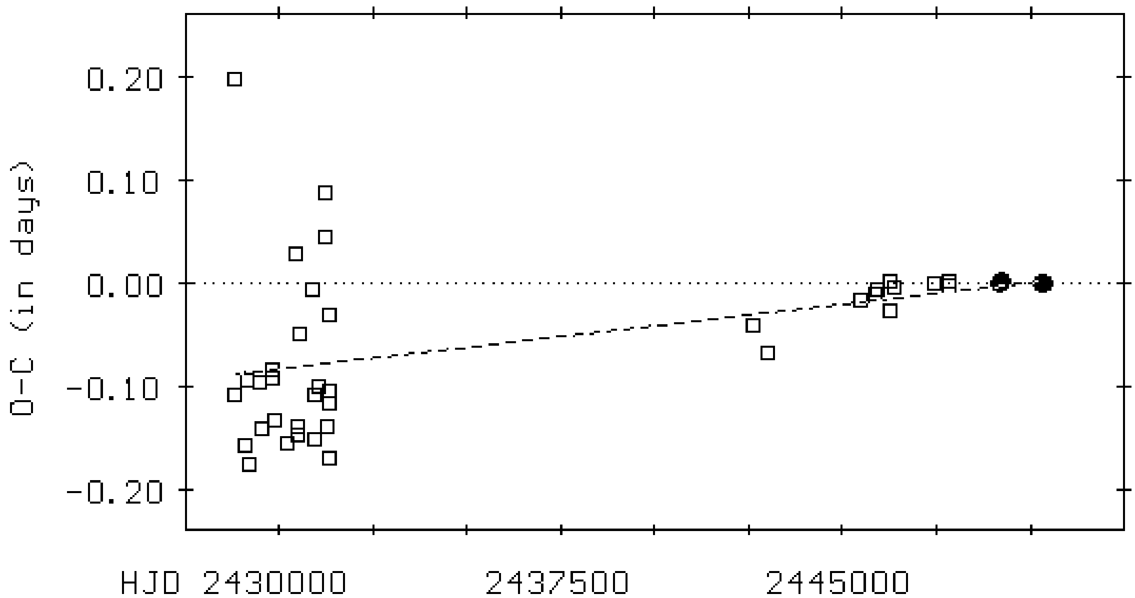

Figure 2 O−C diagram for V694 Aql using the new ephemeris (??) (dots) and the ephemeris (??) (dashes). • represent CCD measured minima and □ minima on photographic plates

Table 1. Observed times of minima for V694 Aql, epochs and residuals computed with respect to the linear ephemeris (??) derived in this paper.

JD hel. 2400000+	W	T*	Epoch	O−C	Lit	JD hel. 2400000+	W	T*	Epoch	O−C	Lit
28782.357	1	P	−26200.0	−0.109	[1]	31352.341	1	P	−23068.0	−0.169	[1]
28809.332	1	P	−26168.5	+0.198	[1]	42630.469	1	P	−9324.0	−0.041	[2]
29106.436	1	P	−25805.0	−0.157	[1]	43019.394	1	P	−8850.0	−0.069	[2]
29111.422	1	P	−25799.0	−0.095	[1]	45493.483	1	P	−5835.0	−0.017	[2]
29166.320	1	P	−25732.0	−0.175	[1]	45854.543	1	P	−5395.0	−0.011	[2]
29463.448	1	P	−25370.0	−0.096	[1]	45905.423	1	P	−5333.0	−0.006	[2]
29546.281	1	P	−25269.0	−0.141	[1]	46271.407	1	P	−4887.0	+0.001	[2]
29783.476	1	P	−24980.0	−0.093	[1]	46289.432	1	P	−4865.0	−0.027	[2]
29824.513	1	P	−24930.0	−0.084	[1]	46354.279	1	P	−4786.0	−0.005	[2]
29879.443	1	P	−24863.0	−0.133	[1]	47438.265	1	P	−3465.0	−0.001	[2]
30199.445	1	P	−24473.0	−0.156	[1]	47822.297	1	P	−2997.0	+0.002	[2]
30446.623	1	P	−24172.0	+0.029	[1]	47859.218	1	P	−2952.0	−0.003	[2]
30496.510	1	P	−24111.0	−0.139	[1]	49168.4495	10	E	−1357.5	−0.0010	[2]
30547.475	1	P	−24049.0	−0.050	[1]	49250.51	5	E:	−1257.5	+0.00	[2]
30904.469	1	P	−23614.0	−0.007	[1]	50279.5170	10	E	−3.5	+0.0063	[3]
30931.445	1	P	−23581.0	−0.110	[1]	50281.5613	10	E	0.0	−0.0008	[4]
30940.430	1	P	−23570.0	−0.151	[1]	50284.4323	10	E	3.5	−0.0018	[3]
31028.283	1	P	−23463.0	−0.100	[1]	50286.4844	10	E	6.0	−0.0012	[4]
31229.510	1	P	−23218.0	+0.086	[1]	50300.4350	10	E	23.0	−0.0004	[5]
31238.495	1	P	−23207.0	+0.045	[1]	50314.3843	10	E	40.0	−0.0008	[3]
31292.468	1	P	−23141.0	−0.140	[1]	50332.4376	10	E	62.0	−0.0002	[2]
31324.506	1	P	−23102.0	−0.105	[1]	50360.3369	10	E	96.0	−0.0005	[2]
31325.400	1	P	−23101.0	−0.031	[1]	50381.2612	10	E	121.5	−0.0009	[5]
31343.366	1	P	−23079.0	−0.118	[1]	50383.3138	10	E	124.0	+0.0003	[2]

*) P denotes photographic minima and E CCD observed minima.
Those marked with ':' got reduced weight.

[1]: E. Rohlfs: VSS 1.236, [2]: W. Moschner: this paper, [3]: P. Frank: this paper, [4]: P. Frank & W. Moschner: this paper, [5]: W. Kleikamp: this paper

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UBV PHOTOMETRY OF THE W UMa STAR BH Cas

The eclipsing binary BH Cassiopeiae was re-established as a W UMa-type star by Metcalfe (1995). Observations in the V–band were obtained in 1994 and 1995 at the Steward Observatory 1.5-m telescope using the 2kBig CCD. Photoelectric observations in the U– and B–bands were obtained in 1996 at the McDonald Observatory 2.1-m telescope. The extinction-corrected, normalized data are shown in Figure 1.

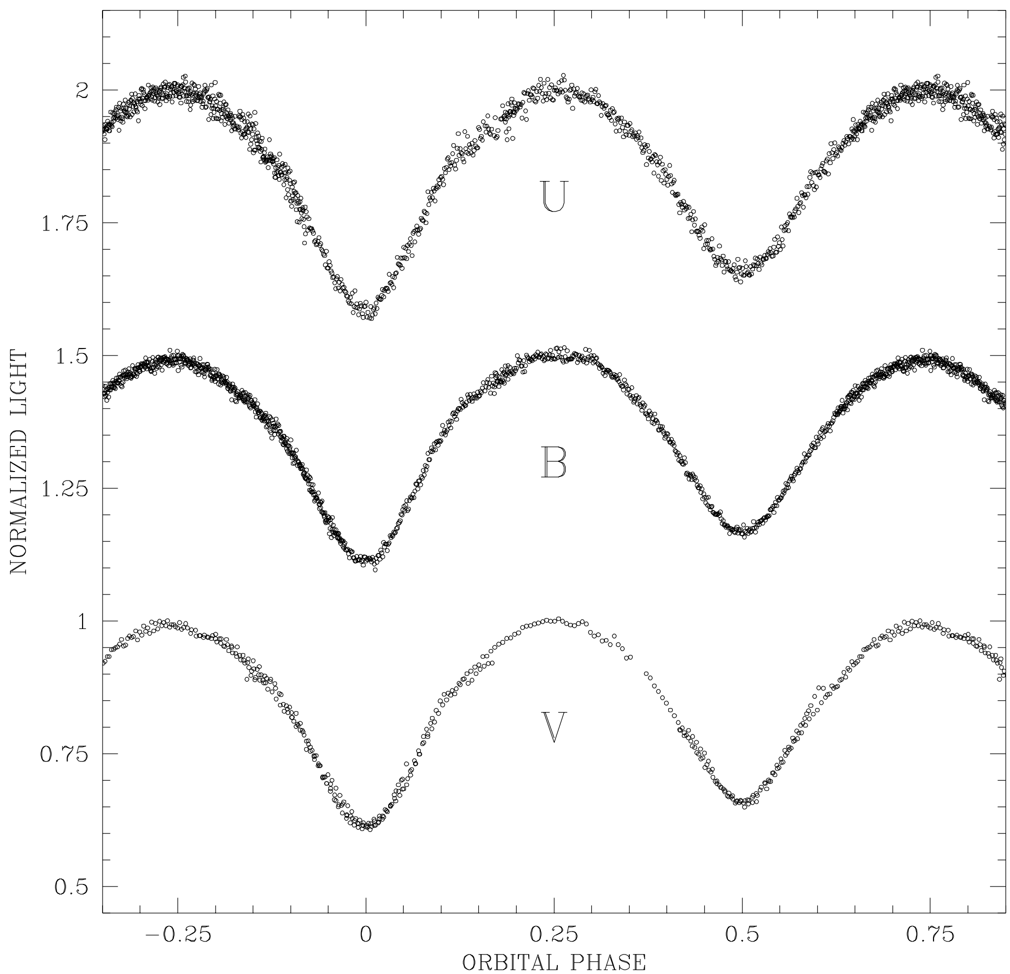

Figure 1. UBV observations of BH Cas, phased with the ephemeris given in this paper.

Times of minimum light were derived from quadratic fits to the 12 minima included in the B– and V–band data (see Table 1), and the following ephemeris was determined:

$$\text{Min I} = \text{HJD } 2449998.618(7 \pm 3) + 0\overset{\text{d}}{.}405890(04 \pm 13) \times \text{E}$$

Table 1. Observed times of minimum light for BH Cas.

Type	HJD of Min.	Epoch	Type	HJD of Min.	Epoch
II	2449634.7378	−896.5	I	2449978.7288	−49.0
I	2449767.6665	−569.0	II	2449998.8213	+0.5
II	2449970.8154	−68.5	I*	2450429.6738	+1062.0
I	2449971.8315	−66.0	II*	2450430.6883	+1064.5
II	2449977.7170	−51.5	I*	2450431.7023	+1067.0
I	2449977.9187	−51.0	II*	2450436.7780	+1079.5

*Times derived from B–band data.

Spectroscopic observations to be obtained from McDonald Observatory will allow the absolute masses and radii of the two components to be determined. Further constraints would be possible with the addition of R– and I–band light curves where BH Cas is brighter ($m_R = 12.3, m_I = 11.7$). Collaboration with observers at longitudes much different than McDonald Observatory ($L_w \simeq 6^h56\overset{m}{.}1$) on the spectroscopic observations is most welcome.

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Metcalfe, T.S., 1995, *IBVS*, No. 4197

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HD 102541: A PULSATING CANDIDATE λ BOOTIS STAR

The candidate λ Bootis star HD 102541 was observed during five nights with the "modular photometer" at the 0.5m telescope (observer: R. Kuschnig), operated by the South African Astronomical Observatory (SAAO). The characteristics of these nonmagnetic, metal-deficient Population I, A- to F-type dwarfs are described in more detail by Paunzen et al. (1997). The journal of observations and the chosen comparison stars are listed in Table 1. The light curve shown in Fig. 1 reveals the photometric variability of the program star with respect to both comparison stars. The applied standard time series analysis (Wei 1990) to the high quality data results in the amplitude spectrum and spectral window shown in Figure 2. The highest signal (6σ detection) appears at the frequency of 20 d^{-1} (232 μHz) which refers to a period of 72 min and the peak to peak amplitude is about 30 mmag in Strömgren v. These values are typical compared to previous results obtained by our survey for pulsating λ Bootis stars (Paunzen & Handler 1996).

In order to establish the membership of HD 102541 to the λ Bootis group, an intermediate resolution spectrum (0.9 Å/pixel) was obtained in the night of 13./14.06.95 (observer: E. Paunzen) with the Cassegrain spectrograph of the 1.6m telescope at Itajuba, Brazil.

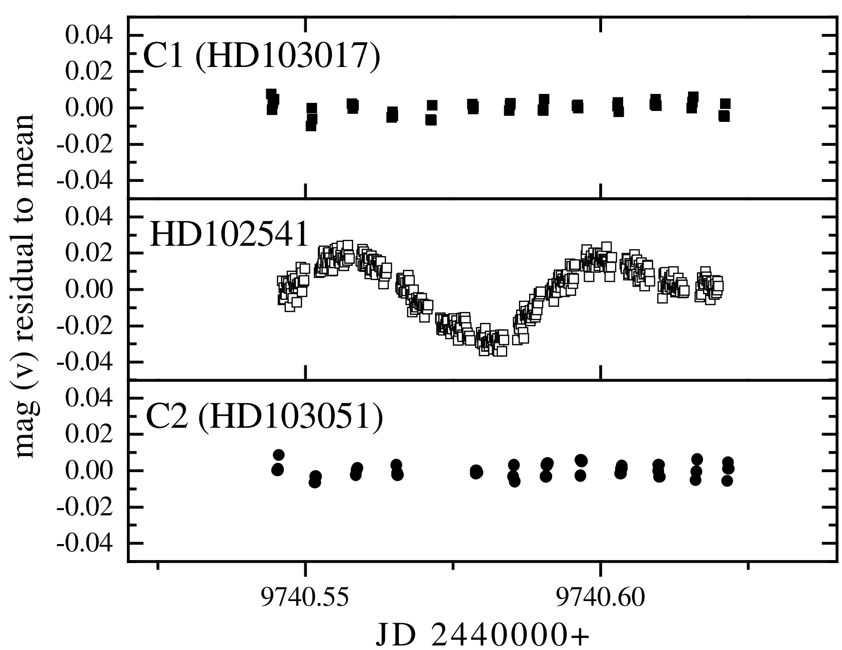

Figure 1. Light curve of HD 102541 and both comparison stars for the first night in Strömgren v

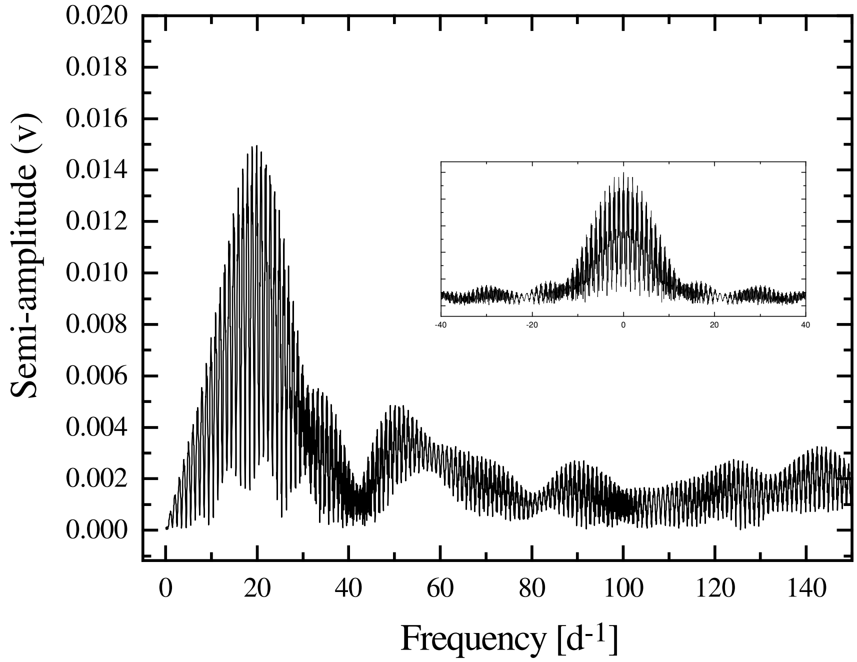

Figure 2. Amplitude spectrum and spectral window for the merged differential data of all five nights [HD 102541 – HD 103017] in Strömgren v

Table 1. Journal of observations for the program and comparison stars

Star	Durchm.	JD	hours	m_V	Spec.
HD 102541	CD −39° 7307	2449740	2	8.0	(λ Boo)
		2449741	2.5		
		2449742	1.5		
		2449744	2		
		2449747	1		
HD 103017	CD −39° 7339			7.7	F3IV/V
HD 103051	CD −40° 6992			7.4	F5V

Houk (1978) classified HD 102541 as A3 II/III. The Strömgen colours ($b-y=0.163$, $m_1=0.141$, $c_1=0.810$, $\beta=2.798$; Gray & Olsen 1991), on the other hand, indicate that this star is actually a metal-deficient dwarf. Using the calibrations of Crawford (1979) and Napiwotzki et al. (1993), we derive $T_{eff}=7700(200)$ K, $\log g=4.1(2)$ (typical for luminosity class V), $\delta m_0=0.053(10)$ and $M_{Bol}=2.5(3)$. The discrepancy between the luminosity classification given in the Michigan catalogue and a reclassification with higher resolution spectra, is a common fact for λ Bootis stars (Gray 1991). We classify HD 102541, based on the spectrum showed in Figure 3, as kA3hA5mA3 V (LB), please note that the Mg II 4481-line is normal for A3 and not remarkably weak.

Many similarities of HD 102541 to the pulsating ($P_{obs}=84$ min) λ Bootis star HD 168947 are obvious (Paunzen et al., 1994). This star was also classified as A3 II/III, but turned out to be a metal-deficient dwarf. Both stars are almost at the same place in the H-R diagram resulting in a comparable pulsation behaviour (observed period and amplitude). The observed period for HD 102541 is very close to the theoretical radial fundamental mode ($P_{th}=67$ min) derived by the PLC-relation taken from Stellingwerf (1979) making this star to an interesting target for an international multisite campaign.

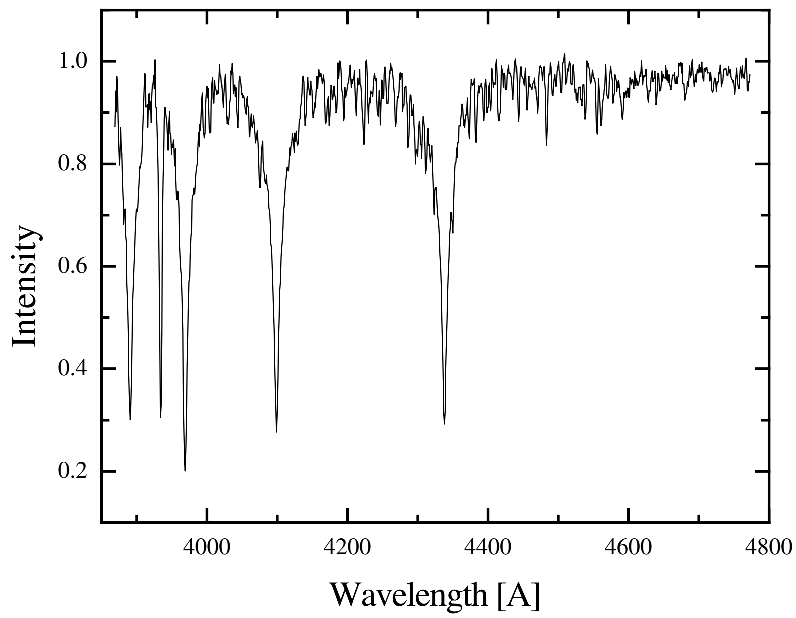

Figure 3. Intermediate resolution (0.9 Å/pixel) spectrum of HD 102541

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RADIAL VELOCITY CURVES AND FIRST CALCULATIONS OF THE RADII FOR FOUR DOUBLE-MODE CEPHEIDS

Double-mode Cepheids form a specific group of Cepheids which includes a limited number of stars. The light and radial velocity curves of these stars show double-mode variations, whereas ordinary Cepheids show only one period. The ratio of periods is almost the same for most of these stars and is close to 0.71, in agreement with the theoretical ratio of periods of the first overtone P_1 to fundamental tone P_0. For CO Aur, unlike other stars, this ratio is close to 0.8; one can imagine (based on the theory of stellar pulsations) that this star pulsates both in the second and first overtone modes.

Berdnikov (1992, 1993) used a large number of original photoelectric observations of 14 double-mode Cepheids to decompose their light and color curves into two oscillations. Since 1987, we have carried out systematic measurements of radial velocities of northern Cepheids with a correlation spectrometer designed and made by Tokovinin (1987). Most part of these observations were included in our two catalogues (Gorynya et al., 1992, 1996). These data, combined with our unpublished observations, allowed us to derive separate radial velocity curves for two oscillations in five photometrically well-studied Cepheids (V367 Sct, EW Sct, BQ Ser, TU Cas, CO Aur).

Note that clear separation of radial velocity curves into two oscillations was made possible by long sets of observations resulting in good coverage of radial velocity curves.

Figures 1-5 show the decomposed radial velocity curves for each mode.

We used these curves to estimate the radii of the four double-mode Cepheids using Balona's method (1977), which is a modification of the well-known Baade–Wesselink technique (Wesselink, 1946). We were forced to simplify our analysis because the number of radial velocity observations is much less than that of photometric measurements, and radial velocities alone do not permit us to find the relation between the amplitudes and phases of the two modes found earlier in photometric data (Berdnikov, 1992, 1993). We therefore assumed that the two oscillations are independent of each other.

In this case the main least squares equation can be written as

$$V = A(B-V) - 5\lg(< R > + r_0 + r_1) + C$$

where V and $(B-V)$ are current magnitude and colour; $< R >$, mean Cepheid radius in $R_\odot$; and A and C, the constants to be found. The total pulsational radius variation $r = r_0 + r_1$ can be found by direct integration of radial velocity curves for two modes:

$$r = -pP_0/R_\odot \int V_{r0} d\phi_0 - pP_1/R_\odot \int V_{r1} d\phi_1$$

We use two color indices, $(B-V)$ and $(V-R)$, as the effective temperature indicators. Table 1 gives the Cepheid radii and their formal errors.

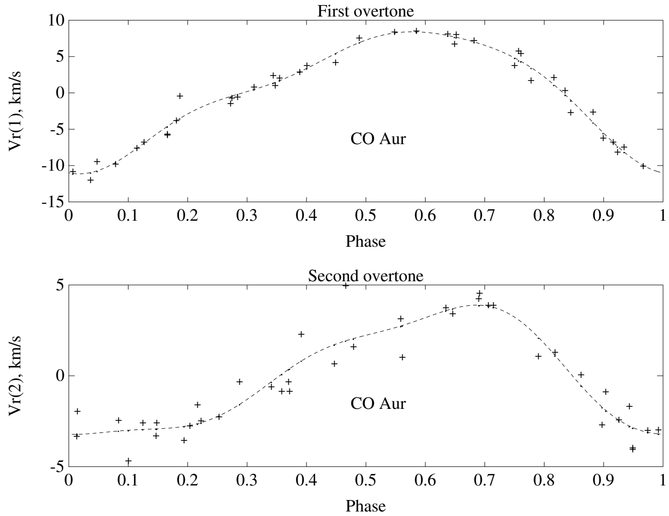

Figure 1

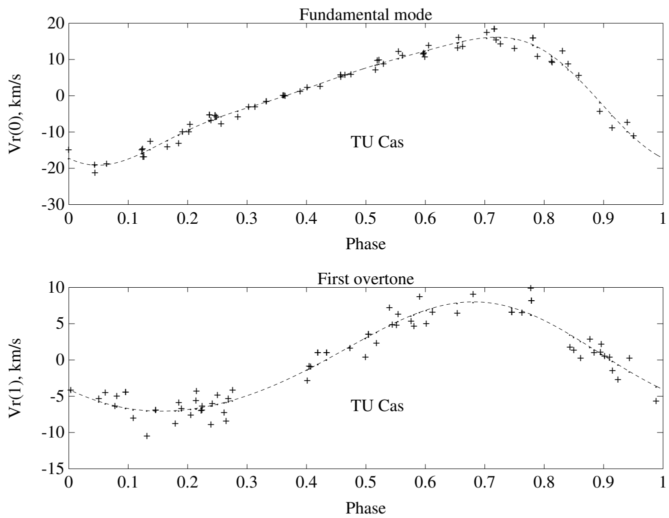

Figure 2

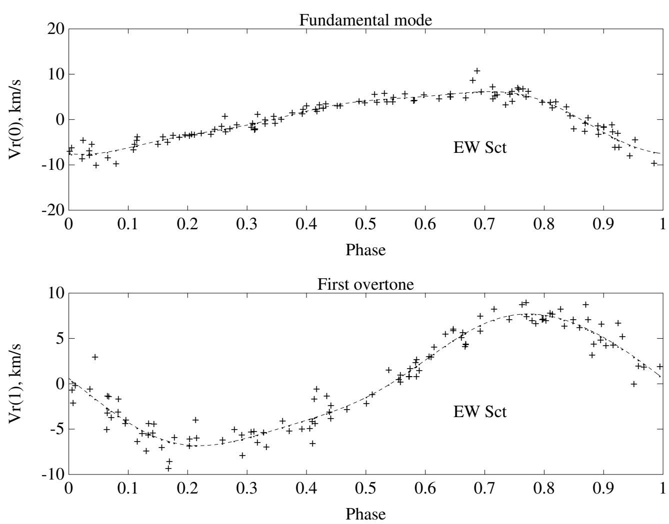

Figure 3

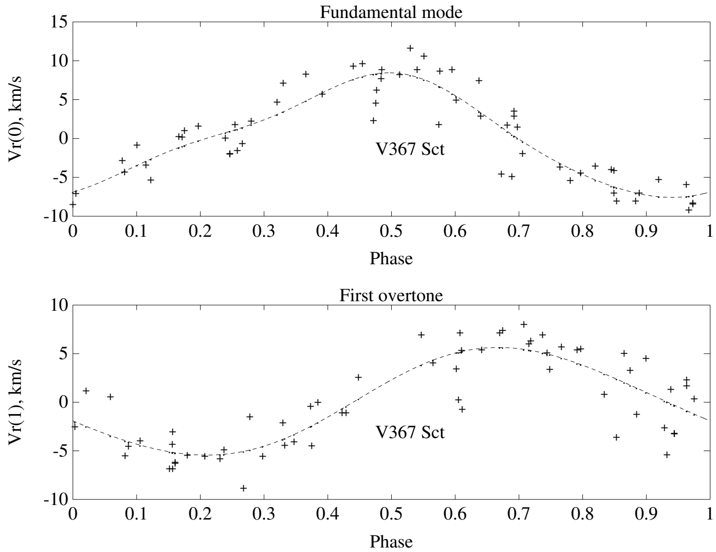

Figure 4

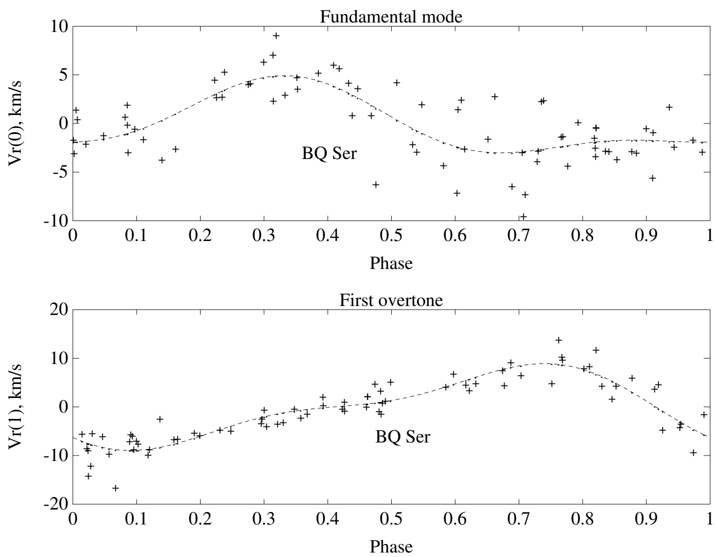

Figure 5

Table 1

Star	P_0	P_1	$R_{B-V}/R_\odot$	σ_R	$R_{V-R}/R_\odot$	σ_R
EW Sct	$5^{\mathrm{d}}.8233$	$4^{\mathrm{d}}.06714$	57	14	50	10
BQ Ser	4.2756	3.01191	56	19	35	14
TU Cas	2.1393	1.51827	31	2	25	3
CO Aur	2.5113	1.78300	40	10	30	5

Radial velocity data for the faintest star, V367 Sct, cannot be used for calculations because of large observational errors.

We derived the following period–radius relations for the four double-mode Cepheids assuming that CO Aur oscillates in the first and second overtones.

$$\lg R = \underset{\pm .08}{1.33} + \underset{\pm .14}{0.59} \lg P_0 \qquad \text{for } (B-V)$$

$$\lg R = \underset{\pm .07}{1.21} + \underset{\pm .12}{0.61} \lg P_0 \qquad \text{for } (V-R)$$

These relations agree well with that for single-mode Cepheids (Ripepi et al., 1997; Sachkov et al., 1997); we consider this agreement to be a justification of our technique applied to the double-mode Cepheids.

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A NEW DOUBLE-MODE CEPHEID IN SCUTUM

The variability of BD$-10°4669$ (GSC 5681.0292; $\alpha = 18^{h}22^{m}27\overset{s}{.}1$, $\delta = -10°07'29''$ (J2000.0); $l = 20\overset{\circ}{.}6$, $b = +1\overset{\circ}{.}7$) was discovered on Moscow collection plates taken with the 40-cm astrograph in Crimea.

The new variable was estimated by eye in B band on 221 plates for the interval JD2438964–48179. The variability range is $10\overset{m}{.}5 - 11\overset{m}{.}5$. B-band magnitudes of comparison stars (Table 1) were measured photoelectrically by L.N. Berdnikov (private communication).

Table 1. Comparison Stars

GSC	$\alpha(2000.0)$	$\delta(2000.0)$	B
5681.1238	$18^{h}22^{m}22\overset{s}{.}4$	$-10°05'53''$	$10\overset{m}{.}63$
5681.0344	$18^{h}22^{m}44\overset{s}{.}7$	$-10°00'23''$	$11\overset{m}{.}78$

The results of the frequency analysis are presented in Figure 1. The step in frequency is about 10^{-5} c/d. We can see the existence of two frequencies in the spectrum – f_0 and f_1 and their 1-day aliases. The second group of frequences (f_0 and 1-day aliases) is more clearly seen in Figure 1b, where f_1 is whitened.

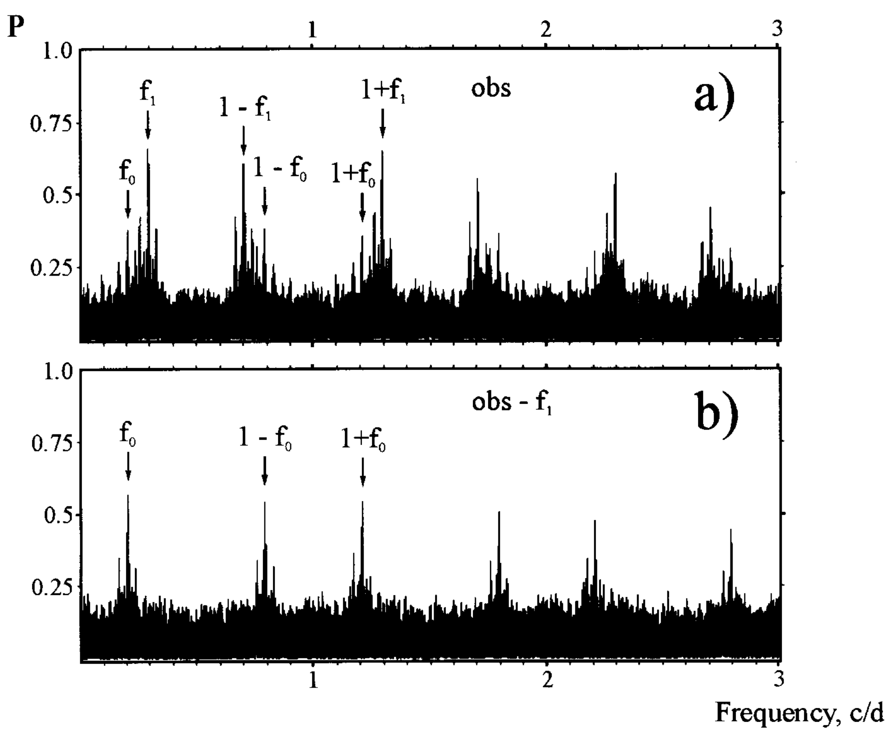

Figure 1. The power spectra

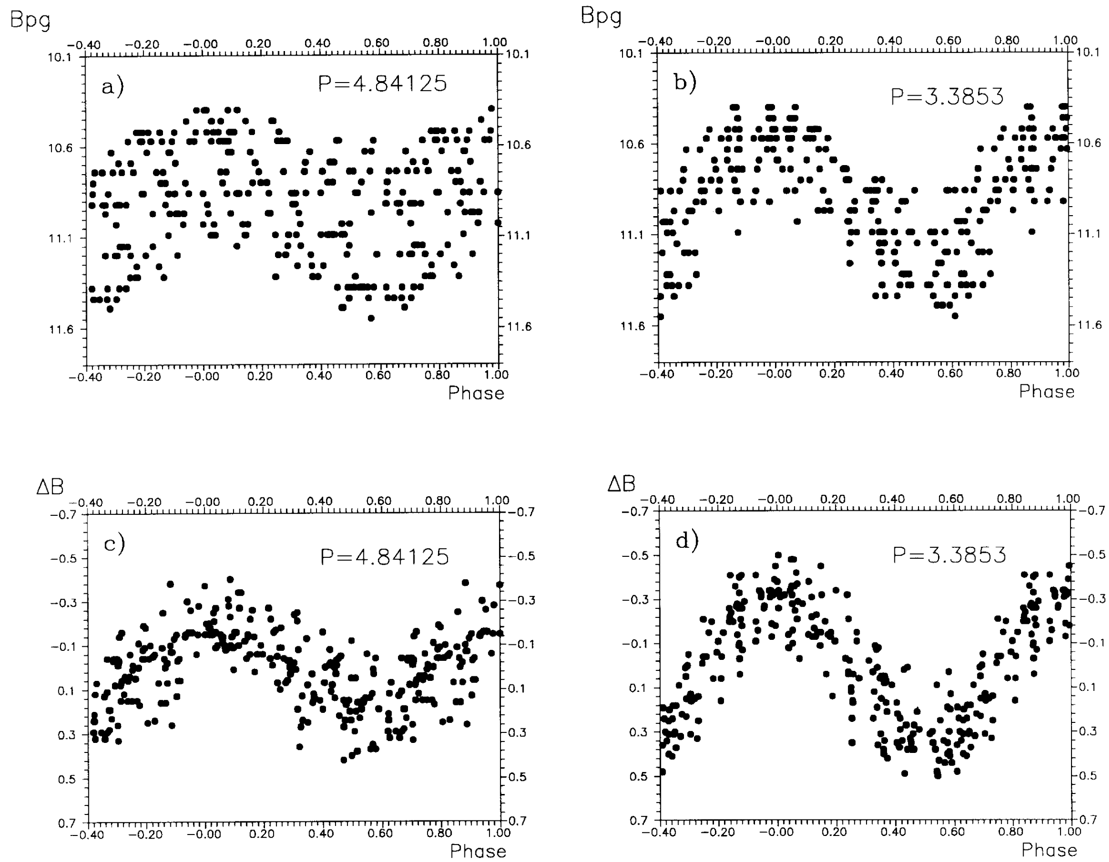

Figure 2. The phased light curves: a.) fundamental mode; b.) first overtone mode; c.) fundamental mode where first overtone has been whitened; d.) first overtone where fundamental mode has been whitened

The peaks in the spectrum at frequencies f_1 and $1+f_1$ are almost equal. But, to have a reasonable decision, we should consider the frequency f_1 as real. In this case, the periods and the period ratio $P_1/P_0 = f_0/f_1 = 0.699$ are typical for double-mode Cepheids. The shapes of the phased light curves, constructed with the periods P_0 and P_1 (Fig. 2cd), are in agreement with the CEP(B) type too. The first overtone phased light curve has a sinusoidal shape ($M - m \sim 0.5$).

So, we classify BD$-10°4669$ as a new Cepheid, pulsating in two radial modes with the light elements:

$$\mathrm{JD}_{\max} = 2447733.42 + 4\overset{\mathrm{d}}{.}84125 \times E \text{ (fundamental mode) and}$$

$$\mathrm{JD}_{\max} = 2441177.37 + 3\overset{\mathrm{d}}{.}3853 \times E \text{ (first overtone mode).}$$

The error of period determinations is $\pm 0\overset{\mathrm{d}}{.}0001$.

Average amplitudes in B band are $A_0 \approx 0\overset{\mathrm{m}}{.}40$ and $A_1 \approx 0\overset{\mathrm{m}}{.}65$. It is necessary to mention that, among Galaxy's double-mode Cepheids, the only one, AX Vel, has the amplitude of an first overtone mode exceeding that of the fundamental mode. BD$-10°4669$ is the second known double-mode Cepheid with the same peculiarity. But this is not a rare phenomenon. Among 30 beat Cepheids (that pulsate in fundamental and first overtone modes), discovered by MACHO Project in LMC, 11 show the strongest peak in the power spectrum at the first overtone (Alcock et al., 1995).

The author would like to thank Dr. N.N. Samus for his help and attention to this investigation, to express gratitude to Dr. L.N. Berdnikov for photoelectric observations of the comparison stars and for useful discussion, and to Drs. S.Yu. Shugarov and V.P. Goranskij for software used in this work. This study was partially supported by the Russian Foundation for Basic Research through grants Nos. 96-15-96656 and 97-02-16739.

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THE ECLIPSING BINARY RX J1326.9+4532

The sky was surveyed in the X-ray region of the spectrum by the ROSAT satellite (Voges et al., 1997) and catalogs of the sources included RX J1326.9+4532 = GSC 3460_780 (Jenkner et al., 1990). A literature search using SIMBAD shows that the star has a large proper motion measured (Giclas et al., 1965) to be −.18"/an in right ascension and −.20"/an in declination. The star was one of the objects found in a survey by Beers et al. (1994), who concluded from objective prism spectral observations that it was "a faint star displaying moderate CaII H&K emission".

The automated 0.5-m. telescope, Cousins R filter and CCD camera of the Climenhaga Observatory of the University of Victoria (Robb and Honkanen, 1992) were used to make photometric observations of RX J1326.9+4532. Using IRAF [1] routines the frames were de-biased and flat fielded, and the magnitudes were found from 6 arc second aperture photometry after using the Gaussian centering option of the PHOT package.

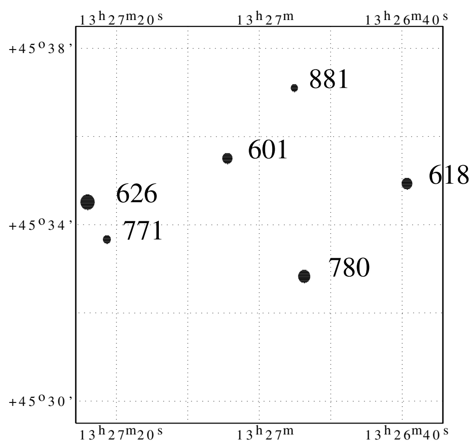

Figure 1. Finder chart of the field labelled with the GSC numbers (Jenkner et al., 1990)

The field of stars is shown in Figure 1 and their designations, coordinates (J2000) and magnitudes from the Hubble Space Telescope Guide Star Catalog (GSC) (Jenkner et al., 1990) and the ΔR magnitudes are tabulated in Table 1. The ΔR differences in magnitude are found from our data in the sense of the star minus GSC 3460_626. To look for brightness variations during a night the standard deviation of the differential magnitudes for each star during a night were calculated and ranged from $0^{m}_{.}006$ for a bright star on a good night to $0^{m}_{.}030$ for the faint stars on poor nights. To measure night to night variations a run mean of the seven nightly averages was calculated and is shown

[1] IRAF is distributed by National Optical Astronomy Observatories, which is operated by the Association of Universities for Research in Astronomy, Inc., under contract to the National Science Foundation

Table 1. Stars observed in the field of RX J1326.9+4532

GSC No.	RA J2000	Dec. J2000	GSC Mag.	ΔR Mag.	V	$(V-R)_C$
3460_780	$13^h26^m54^s$	+45°32'50"	12.5	variable	12.80	0.88
3460_601	$13^h27^m04^s$	+45°35'30"	13.4	$+1.966 \pm .009$	13.58	0.37
3460_626	$13^h27^m24^s$	+45°34'31"	11.6	–	11.81	0.54
3460_771	$13^h27^m21^s$	+45°33'40"	14.5	$+2.885 \pm .019$	-	-
3460_881	$13^h26^m55^s$	+45°37'06"	14.8	$+3.404 \pm .048$	-	-
3460_618	$13^h26^m39^s$	+45°34'56"	13.2	$+1.792 \pm .031$	-	-

as ΔR in Table 1. We consider GSC 3460_780 to be the only significantly variable star. Due to the small field of view extinction effects were negligible and no corrections have been made for them. No corrections have been made to transform the R magnitude to a standard system.

Brightness variations in RX J1326.9+4532 were evident during a night. A least squares fit of a single sine wave to all the the data shows a deep minimum in χ^2 at a period of $0\overset{d}{.}18$, but a plot of the light curve shows unequal maxima which led us to double the period. An eclipse was also apparent with ingress and egress not resolved. On three occasions the observations were terminated by clouds or dawn during the eclipse, but we could clearly see the ingress of the primary minimum seven times and the Heliocentric Julian Dates (2450000+) were 550.9137, 560.0163, 560.7451, 562.9295, 570.9392, 576.7641, and 578.9498 with an uncertainty of about 0.0008 days. A fit to these times, corrected to mid eclipse gives the ephemeris:

$$\text{HJD of Minima} = 2450550\overset{d}{.}9246(3) + 0\overset{d}{.}364095(7) \times \text{E}.$$

A plot of the differential (GSC 3460_780−GSC 3460_626) R magnitudes phased at this period is shown in Figure 2 for our two best nights. Clearly there is a difference of about $0\overset{m}{.}02$ after the first maximum, but no difference in the second maximum. Most of the other nights agreed with the data marked with "+" symbols.

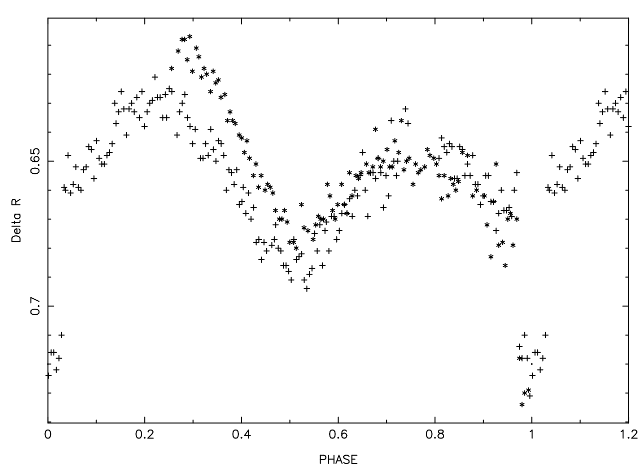

Figure 2. R band light curve of RX1326.9+4532 for HJD 2450560(+) and 2450562(∗)

To help classify the variable star V and R frames were obtained under photometric conditions along with observations of the nearby bright standard star HR 5112 (Moffett and Barnes, 1979). The V band brightness and $(V-R)_C$ colors are listed in Table 1 for the three brightest stars. However great caution should be exercised in using these data since they are derived from only one standard star and its (V−R) was transformed from the Johnson system to the Cousins system using Taylor's (1986) equations. While certainly not definitive these colors confirm that RX J1326.9+4532 is a late type (approximately M0V) star (Cousins 1981). A dwarf star of this color would be expected to have an absolute magnitude of approximately V=9.0 (Allen 1976) so from our apparent magnitude we find the distance to be about 60 parsecs. Combined with the proper motion we find a large tangential velocity of 76 km/sec. Observations were continued in the V and R filters through the eclipse and the depths were measured to be $0\overset{m}{.}054 \pm 0\overset{m}{.}010$ in R and $0\overset{m}{.}128 \pm 0\overset{m}{.}029$ in V.

Since no points were observed on the descending or ascending branches of any primary minimum, we observed with no filter and decreased the exposure time to 33 seconds for a repetition rate of 54 seconds. Still no points were seen on the descending branch and only one possibly on the ascending branch. The duration of the primary minimum was $0\overset{d}{.}0212 \pm 0.0006$ so the ratio of the radii of the two stars must be less than 0.028. All other eclipses were consistent with this duration.

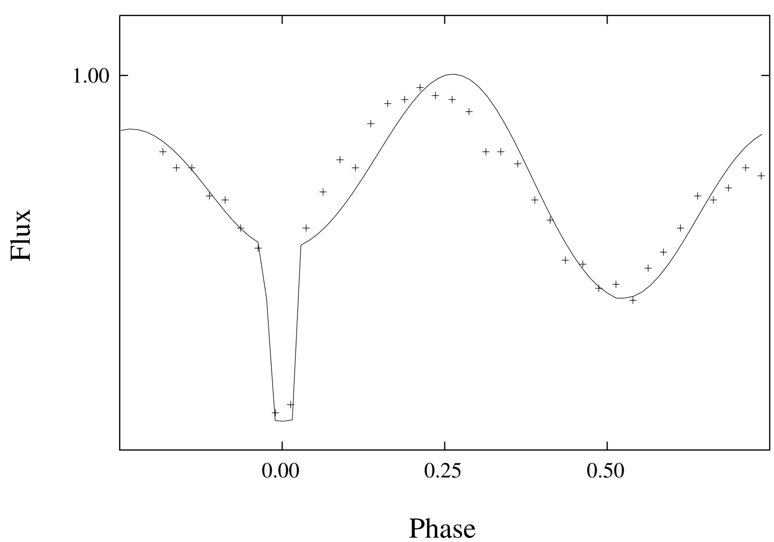

Figure 3. R band light curve (points) with example model (line) of M0V and white dwarf

From the color information and the duration of the eclipse we can surmise that the primary star is a M0V and the secondary star is a white dwarf. Assuming 0.70 and 0.47 solar masses and 0.63 and 0.014 solar radii for the primary and secondary stars respectively (Allen 1976), we find from our period and Kepler's 3^{rd} Law the relative radii of 0.29 and 0.0065. The temperature of the cool star was assumed to be 3480K and from the depths of the minimum the temperature of the white dwarf was estimated, but needed to be adjusted to 10000K. Using these radii, masses and temperatures a model light curve was made with Binmaker 2.0 (Bradstreet 1993) and is shown in Figure 3. The inclination was adjusted to 76° to fit the data, however assuming different masses and radii would require an inclination different by a few degrees. To model the asymmetry in the maxima one spot was used which had a co-latitude of 130°, longitude of 60°, a radius of 13° and a temperature factor of 0.8. All other inputs were set at values appropriate for these temperatures. The cool star is well inside its Roche lobe and it is not likely we will see much evidence of mass transfer.

The star RX J1326.9+4532 is therefore one of a small group of stars very similar to the famous eclipsing binary V471 Tau. Both stars have white dwarf secondary stars and late type primary stars with evidence of starspots from asymmetrical and changing light curves, and X-Ray emission. Further photometric observations with a larger telescope will be valuable to measure the relative radius, the color and thus the temperature of the white dwarf star. Spectroscopic observations will be important to get a good spectral class for the late type dwarf and radial velocities will measure the scale of the system and the masses. The space velocity is also of interest since the tangential velocity implies that the star may belong to Pop II. RG would like to thank the Austrian Ministry of Science for financial support.

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THE FIRST PHOTOELECTRIC OBSERVATIONS FOR THE DOUBLE-MODE CEPHEID BD $-10^{\circ}4669$

Antipin (1997) recently analyzed photographic archival plates at the Sternberg Astronomical Institute in Moscow and found that the star BD $-10°4669$ is a double-mode Cepheid with the elements:

$$\text{fundamental: Max JD}_{hel} = 2447733.42 + 4.84125 \times \text{E},$$

$$\text{first overtone: Max JD}_{hel} = 2441177.37 + 3.3853 \times \text{E}.$$

We observed the Cepheid photoelectrically at the South African Astronomical Observatory in April-May 1997 using the 50-cm reflector. A total of 35 $V(RI)_c$ measurements were obtained (Table 1), the accuracy of the individual data being near $\pm 0\overset{\mathrm{m}}{.}01$ in all filters. The elements cited above are used in Figures 1a and 1b for plotting our new observations.

Table 1

JD_{hel} 2450500+	V	$(V-R)_c$	$(V-I)_c$	JD_{hel} 2450500+	V	$(V-R)_c$	$(V-I)_c$
41.6167	9.630	.706	1.412	77.6427	9.837	.735	1.474
68.5836	9.798	.743	1.460	78.5217	9.720	.721	1.440
70.6007	9.709	.701	1.412	78.5880	9.717	.725	1.443
72.4674	9.848	.743	1.510	78.6386	9.721	.720	1.440
72.5547	9.874	.765	1.517	78.6450	9.717	.727	1.440
73.4990	10.024	.766	1.542	79.5696	9.920	.765	1.516
73.5937	10.046	.783	1.546	80.4662	9.776	.720	1.450
73.6662	10.038	.772	1.549	80.5775	9.739	.715	1.434
74.5287	9.683	.702	1.397	80.6273	9.722	.707	1.427
74.5901	9.659	.689	1.388	82.5589	9.842	.745	1.494
75.4888	9.662	.690	1.401	82.6064	9.886	.753	1.492
75.5739	9.692	.716	1.434	82.6545	9.884	.761	1.511
75.6374	9.698	.703	1.423	83.5498	10.074	.783	1.553
76.5343	9.902	.735	1.512	83.6062	10.052	.766	1.541
76.6163	9.915	.763	1.524	84.5415	9.638	.685	1.381
76.6528	9.917	.762	1.520	84.5977	9.620	.686	1.375
77.5437	9.865	.739	1.489	84.6454	9.593	.662	1.365
77.6024	9.849	.742	1.479				

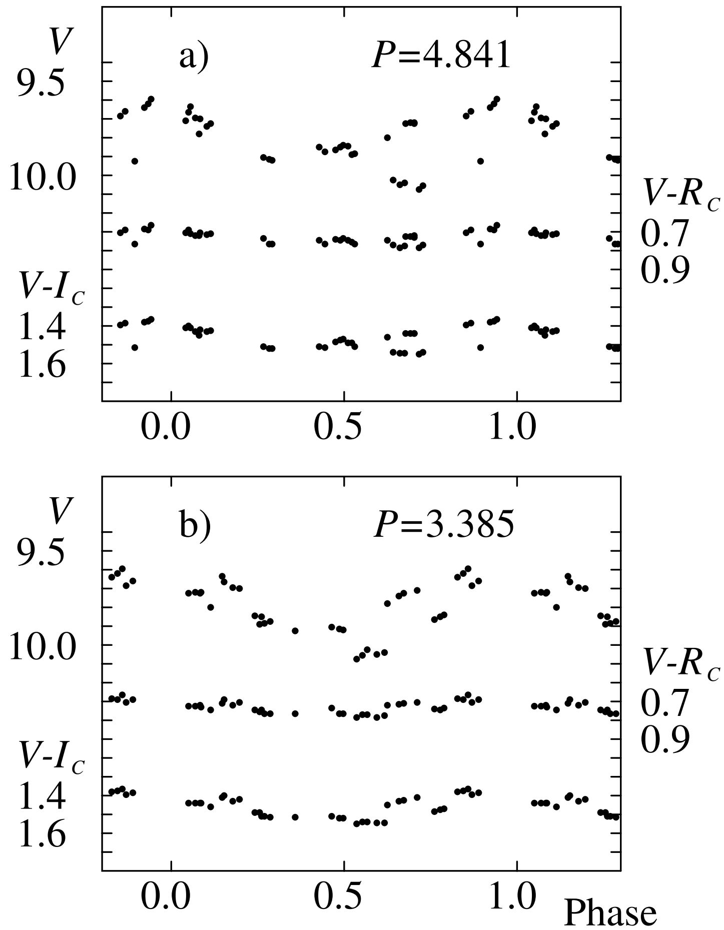

Figure 1

The research described here was supported in part by the Russian Foundation of Basic Research and the State Science and Technology Program "Astronomy" to LNB and through NSERC Canada to DGT. We would also like to express our gratitude to the administration of the SAAO for their allocation of a large block of observing time.

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PHOTOELECTRIC OBSERVATIONS FOR TWO MISCLASSIFIED VARIABLES: AF CRUCIS AND CG SAGITTARII ARE NOT CEPHEIDS

The present note addresses the status of two stars that are identified as Cepheid variables in the fourth edition of the *General Catalogue of Variable Stars*: AF Crucis and CG Sagittarii.

Grayzeck (1978a) found the star AF Cru to be a Cepheid variable with the elements:

$$\text{Max JD}_{hel} = 2441786.576 + 9.297 \times \text{E}.$$

Its V magnitude was found to vary in brightness between 9.75 and 10.10 (Grayzeck 1978b). However, the shape of its light curve is very asymmetric, which is unusual for a classical Cepheid of that period.

Gerasimovic (1927) found CG Sgr, discovered previously by Bailey (1924), to be a long-period Cepheid variable with the elements:

$$\text{Max JD} = 2414127 + 64.1 \times \text{E}.$$

In order to examine the light curves of both stars in greater detail, we observed them photoelectrically at the South African Astronomical Observatory in April-May 1997 using the 50-cm telescope. A total of 29 VR_c measurements were obtained for AF Cru (Table 1), and a total of 43 $V(RI)_c$ measurements were obtained for CG Sgr (Table 2), the accuracy of the individual data being near $\pm 0\overset{\text{m}}{.}01$ in all filters.

It is readily seen that our observations for CF Cru do not satisfy the elements given by Grayzeck and that the star appears not to be varying. A search of the literature revealed that AF Cru was discovered by Uitterdijk (1936) as an eclipsing variable with the elements:

$$\text{Min JD}_{hel} = 2424988.959 + 1.895669 \times \text{E},$$

and a short eclipse duration of $D = 0\overset{\text{p}}{.}06$. Figure 1 illustrates that our observations do not conflict with Uitterdijk's elements. Our data suggest that AF Cru is indeed an eclipsing variable, although we have no measurements near the times of eclipses.

Regarding Grayzeck's (1978b) observations, they do not satisfy Uitterdijk's elements. Our attempts to find a new period using both the present and Grayzeck's observations were unsuccessful.

During the observing run for CG Sgr it was found that the star's brightness varied on a time scale of hours not days, in direct conflict with the elements of Gerasimovic. Although the light amplitude is comparable to that of certain RR Lyrae and δ Scuti variables, the time scale of variability appears to be too small for an object of the RR Lyrae class. It appears that CG Sgr may be a δ Sct star. Our attempts to find new elements for it were unsuccessful.

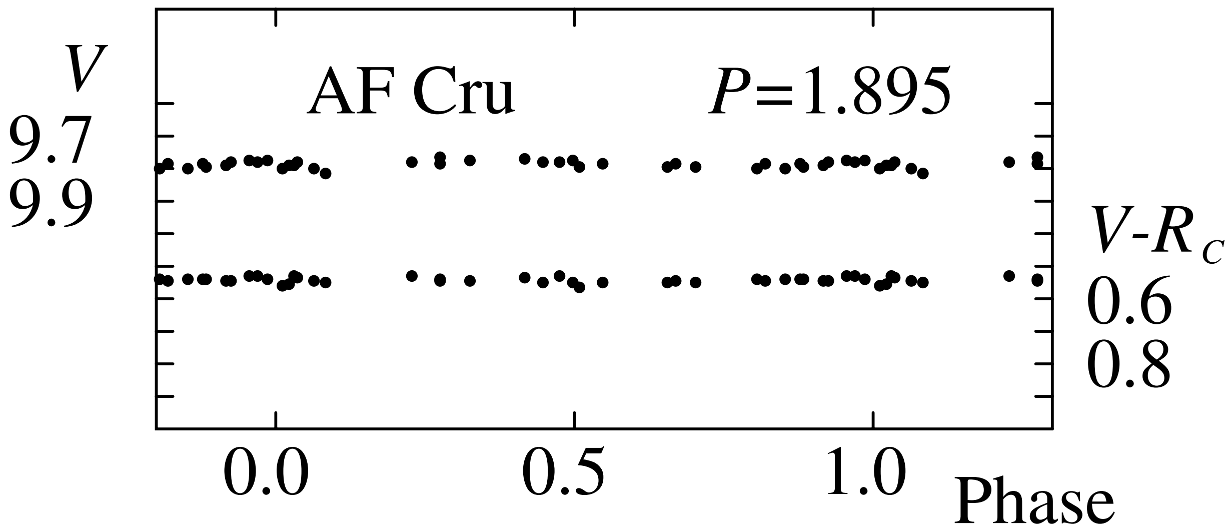

Figure 1

Table 1. VR_c observations of AF Cru

JD_{hel} 2450500+	V	$(V-R)_c$	JD_{hel} 2450500+	V	$(V-R)_c$
41.5860	9.771	.530	78.4412	9.783	.545
42.5988	9.790	.557	79.4437	9.772	.546
68.4660	9.786	.550	80.3507	9.772	.543
70.3868	9.779	.541	80.4086	9.769	.529
72.3457	9.785	.549	80.4347	9.774	.528
73.3404	9.771	.527	82.3603	9.769	.538
73.4321	9.759	.542	82.4283	9.781	.554
74.4629	9.776	.544	82.4573	9.770	.534
75.3275	9.777	.538	83.3326	9.769	.547
75.4246	9.765	.542	83.3538	9.785	.564
76.3313	9.790	.539	83.4255	9.780	.547
76.4218	9.793	.539	84.3438	9.784	.529
76.4791	9.786	.537	84.4066	9.793	.544
77.4913	9.761	.532	84.4412	9.806	.548
78.3662	9.778	.538			

Table 2. VR_c observations of CG Sgr

JD_{hel} 2450500+	V	$(V-R)_c$	$(V-I)_c$	JD_{hel} 2450500+	V	$(V-R)_c$	$(V-I)_c$
72.6293	13.269	1.324	3.046	82.5683	13.459	1.389	3.184
73.6060	13.321	1.353	3.097	82.5976	13.342	1.315	3.037
74.5403	13.262	1.287	3.042	82.6161	13.392	1.353	3.107
74.5990	13.249	1.262	3.015	82.6462	13.429	1.354	3.128
75.5009	13.439	-	3.171	82.6632	13.536	1.417	3.224
75.5846	13.278	1.314	3.029	83.4406	13.497	1.383	3.196
76.5477	13.408	1.389	3.155	83.4440	13.509	1.395	3.192
76.6278	13.273	1.313	3.052	83.4682	13.350	1.342	3.075
77.5546	13.394	1.361	3.136	83.4944	13.543	1.417	3.226
77.6532	13.269	1.310	3.027	83.5598	13.437	1.343	3.114
78.5327	13.488	1.440	3.226	83.6174	13.512	1.423	3.186
78.5982	13.249	1.306	3.026	84.4385	13.620	1.461	3.285
78.6539	13.318	1.357	3.093	84.5003	13.498	1.377	3.189
79.4584	13.457	1.398	3.200	84.5366	13.523	1.417	3.228
79.5264	13.454	1.402	3.184	84.5503	13.446	1.396	3.161
79.5827	13.356	1.374	3.116	84.5676	13.502	1.408	3.201
80.4432	13.490	1.416	3.217	84.5897	13.475	1.424	3.180
80.4777	13.477	1.415	3.206	84.6065	13.443	1.354	3.138
80.5876	13.404	1.392	3.142	84.6243	13.373	1.325	3.102
80.6375	13.347	1.333	3.089	84.6386	13.614	1.457	3.308
82.4762	13.547	1.442	3.238	84.6541	13.369	1.313	3.080
82.5515	13.564	1.443	3.262				

The research described here was supported in part by the Russian Foundation of Basic Research and the State Science and Technology Program “Astronomy” to LNB and through NSERC Canada to DGT. We would also like to express our gratitude to the administration of the SAAO for their allocation of a large block of observing time.

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REVEALING OF A NEW SU UMa TYPE VARIABLE STAR VAR21 CORONAE BOREALIS

Var21 Coronae Borealis was discovered and designated by Antipin (1996). He classified this star as a dwarf nova (U Geminorum type) with a photographic range of 14.5 - <17.5 magnitudes. Several outbursts were observed. Two types of them were found, differing by duration. The longer outbursts with a duration of 15 days or more and the shorter ones lasting about 10 days. This behavior is very common to the SU Ursae Majoris subtype of cataclysmic variables. These variable stars are characterized by the presence of small-amplitude (semi)periodic modulations in the light curve, called *superhumps*. Even though CCD photometry was made by M. Iida (Nagamo, Japan) in 1996 and T. Vanmunster (Landen, Belgium), no superhumps were detected.

During the last superoutburst in May 1997, the CCD photometry at Nicholas Copernicus Observatory and Planetarium in Brno (Czech Republic) was performed on night May 11/12. We used SBIG's CCD camera ST-7 placed in primary focus of 40cm Newtonian telescope (f=1750mm). For automatic reduction aperture photometry package MuniPhot (by Filip Hroch, Masaryk University Brno, using some author's routines), which is based on the well known DaoPhot II - New generation (Stetson, 1987) was used.

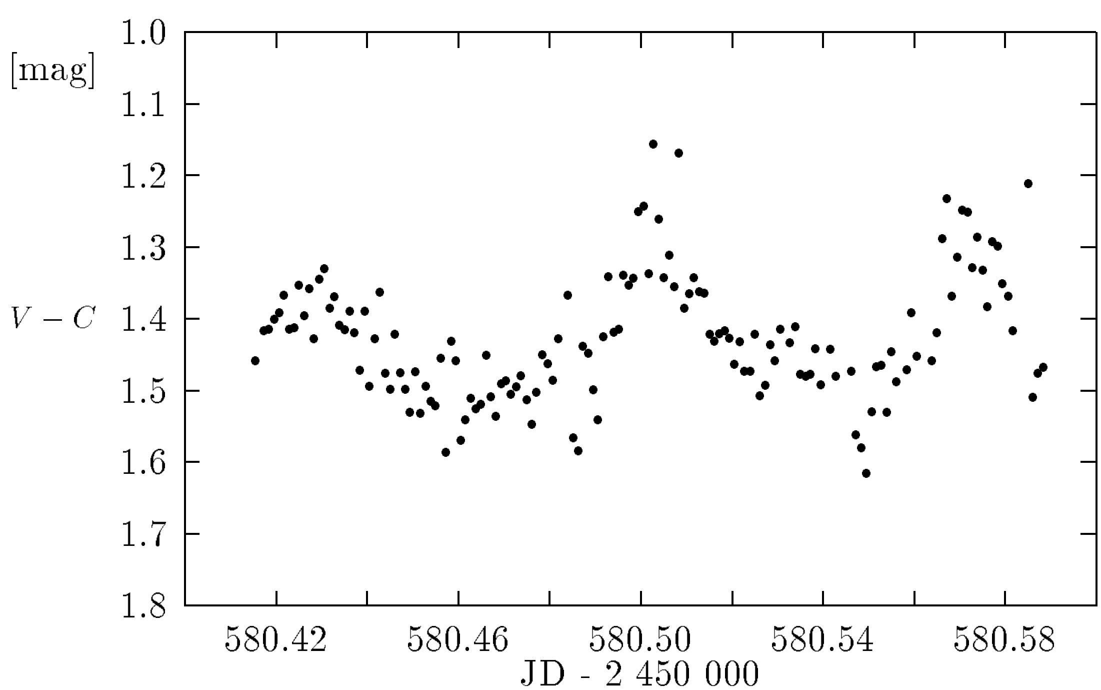

Figure 1. Light curve with three superhump maxima. V−C is difference between variable and comparison star

The observing run started on JD 2450580.42 and ended on JD 2450580.59. Total number of exposures was 147 (two of them were omitted from the list beacuse of clouds). The star was near to 14.6 mag in R-band (Kron-Cousins) filter. Each exposure lasted 90 seconds. All images were processed by standard dark-frame and flat-field corrections. The standard deviation of magnitude of variable star was $\sigma = 0.05$ mag. The star GSC 2576.2027 close to Var21 CrB position was used as a comparison.

In the light curve (Figure 1), three superhump maxima were definitely detected. Using Phase Dispersion Minimization (Stellingwerf 1978) analyzing routines written by Taichi Kato (Kyoto University, Japan) we obtain value of superhump period as P_{SH}=(0.0743 $\pm$ 0.0006) day. This result is well within the range of superhump periods of usual SU UMa stars, which lies below the lower limit of the *period-gap* (Osaki 1996) of cataclysmic variables, which is aproximately from 2 hours to 3 hours.

Independent CCD photometry performed during the same night by Vanmunster (1997) has confirmed our results. So there are good reasons to classify variable star Var21 CrB as an UGSU (U Geminorum, SU UMa subclass) dwarf nova with a range of variability (14.5 - <17.5) mag (P) and coordinates: $\alpha_{2000} = 16^{\mathrm{h}}\ 00^{\mathrm{m}}03\overset{\mathrm{s}}{.}7$ and $\delta_{2000} = 33°11'15''$.

Acknowledgements: The author would like to thank Taichi Kato (and his group) for valuable comments, literature support and providing information, to all administrators of VSNET (Variable Stars Network) home page for their work, to Tonny Vanmunster for notifying about the outburst and independent observation of superhumps confirming our results, Jan Hollan and Zdeněk Mikulášek for valuable comments and manuscript editing, the Masaryk University for Internet access.The author is grateful to Filip Hroch for aperture photometry software support.

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TWO NEW VARIABLE STARS NEAR THE VARIABLE WR 7 (= HD 56925) AND THE CONSTANT WR 18 (= HD 89358)

During our search for variability among Wolf-Rayet (WR) stars on a timescale of minutes to days, we discovered two variable stars in the field of view of WR 7 (= HD 56925, WN4, van der Hucht et al., 1981) and of WR 18 (=HD 89358, WN5). The variability of WR 7 will be reported elsewhere (Veen et al., 1997), while WR 18 appeared to be stable.

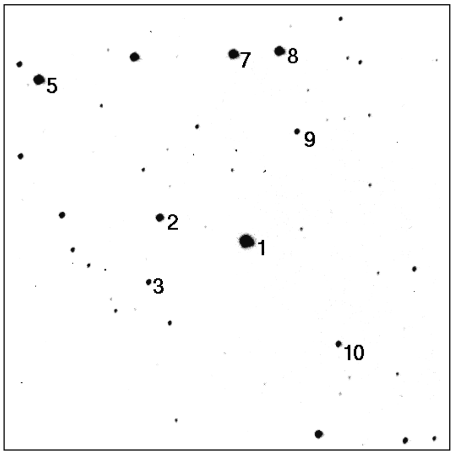
The observations were obtained using the Dutch 90-cm telescope at ESO (La Silla, Chile) equipped with a CCD-camera (ESO#29) and a Bessel B-filter (ESO #419). The observations were performed during two consecutive nights in December 1993 and three nights in January 1994. On each of these nights CCD-images were obtained for 3 to 4 hours continuously, which resulted in a rate of about one frame per two minutes.

Ten stars in the field were picked to see whether they were suitable as comparison stars. Because of different pointings not all stars were recorded in each night. Figure 1 displays a CCD-image of the region around WR 7 (star 1), in which the position of the stars 2, 3, 5, 7, 8, 9, and 10 are indicated. During the analysis star 10 turned out to be variable itself. Stars 5 and 8 varied in brightness probably because of differential atmospheric extinction. Therefore, the differential magnitudes as presented in Figure 3 are computed with respect to the total flux of the stars 2, 3, 7, and 9. Figure 2 displays the field of WR 18. Observations in the night of January 3, 1994 showed star k to be variable. Stars d (=GSC 8608_693), i (=GSC 8608_1711), and j showed marginal photometric variability. Therefore, the differential magnitudes were calculated with respect to stars b (=GSC 8608_799), c, e, f, g, and h (=GSC 8608_1993). We notice that the stars near WR 7 are not listed in the Guide Star Catalogue (=GSC, Lasker et al. 1990, Russell et al. 1990 and Jenkner et al., 1990), probably because of light contamination by the ring nebula NGC 2359 around WR 7.

Table 1 lists the coordinates of the WR objects and of the variable stars. The mean magnitudes (dB_B) are determined with respect either to WR 7 or to WR 18, since they are the only stars in the field for which the B_J magnitude is known (Moffat et al., 1979 and Denoyelle 1977, respectively). However, WR 7 itself is variable at a level of $0^m_.03$ (Veen et al. 1997). The stars near WR 7 have also been investigated by Moffat et al. (1979) from photographic plates. That program was not intended to detect possible variability. Column 6 of Table 1 lists the Johnson B magnitude that they determined.

Table 1. Particulars of the variable stars around WR 7 and WR 18. The numbers and letters in the first column correspond to those in Figures 1 and 2. The positions are determined from the CCD-frames relative to the WR star.

number	name	RA(2000)	Dec(2000)	dB_B	B_J	variability
1	WR 7	07 18 29.0	−13 13 02		$11^m_.68$	$0^m_.01$–$0^m_.03$
10		07 18 32.7	−13 13 54	$15^m_.17$		$0^m_.5$
a	WR 18	10 17 02.3	−57 54 47		$11^m_.26$	$< 0^m_.005$
k		10 17 13.6	−57 56 33	$14^m_.8$		$0^m_.025$



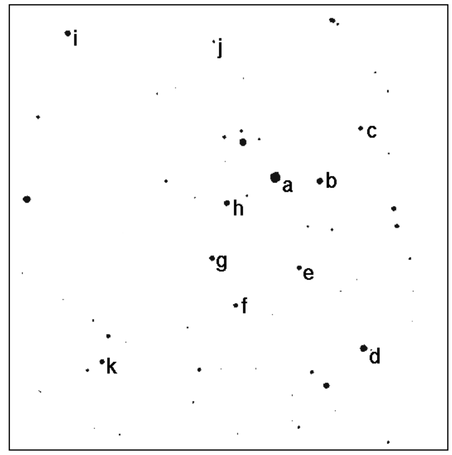


Figure 1 (left). CCD image of WR 7 (star 1). Star 5, 8, and 10 are variable. They are listed in Table 1. East is to the left and north is up. The size of the field is about 3.′7 x 3.′7. Finding charts with a larger field can be found in van der Hucht et al. (1981).

Figure 2 (right). CCD image of WR 18 (star a). Star k showed a clear variability.

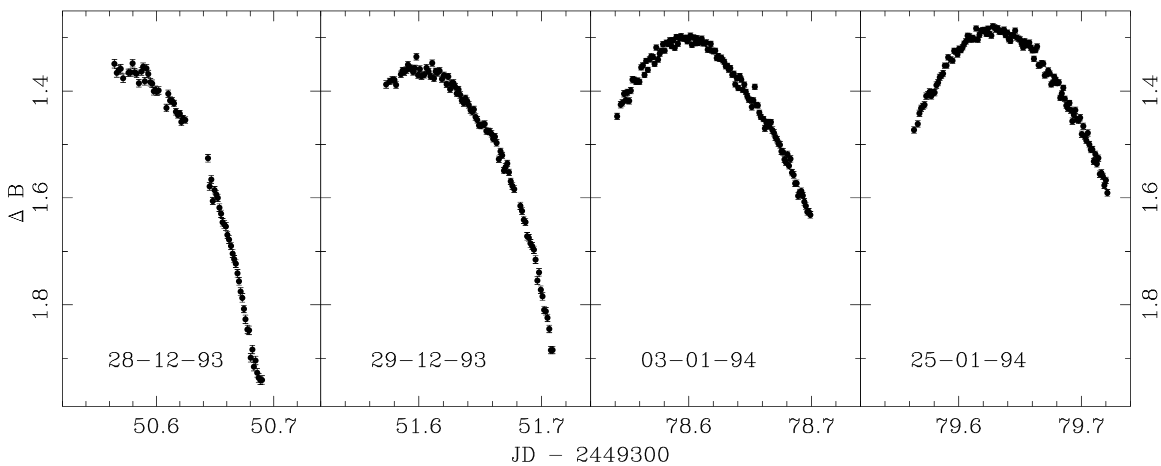


Figure 3. The lightcurves of star 10 near WR 7.

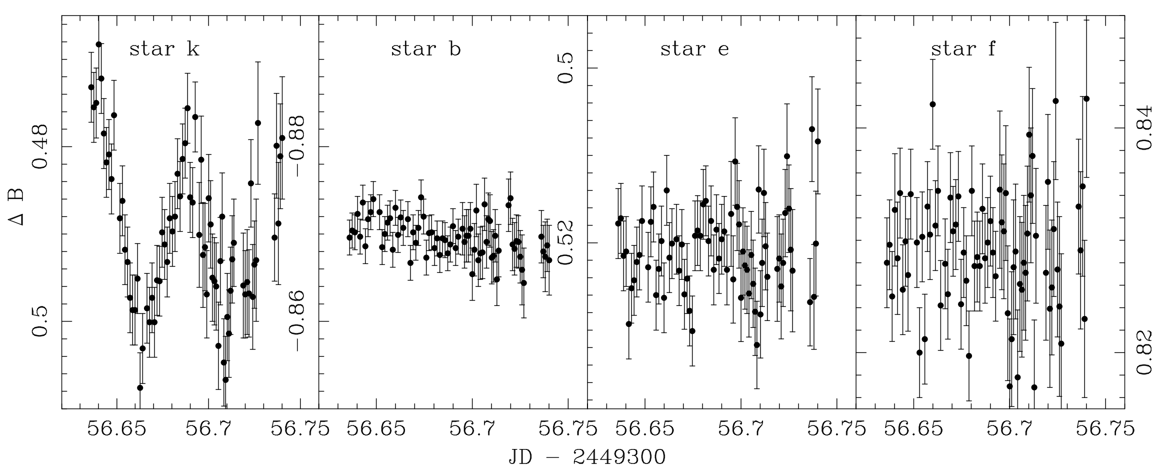


Figure 4. Light variations of star k near WR 18 at 03-01-94. Because of a different pointing star k was not observed at other dates. As a comparison the other diagrams show from left to right the constant light curves of a brighter, an equally bright, and a fainter star in the field.

Figure 3 shows the impressive light variations of star 10 near WR 7. It shows a range not less than $0\overset{m}{.}5$ each night. Our very tentative opinion is that star 10 is a β Lyrae or W UMa type eclipsing binary. In the nights in December we may have observed the ingress to the deep minimum and 27 days later we observed a less steep ingress, possibly to the secondary minimum, half a period later. Note the difference of $0\overset{m}{.}05$ in the height of the two pairs of maxima. We suggest that 52.5 cycles elapsed between the observations in December and January. The period would then be $P = 0.514$ day.

Figure 4 displays the lightcurve of star k near WR 18 together with light curves of a few comparison stars at the same date to illustrate the quality of the data. A cyclicity is suggested amounting to somewhat more than one hour. The increase of scatter of the data points in the course of the night is attributed to increasing cirrus.

Both of these objects need further photometric and spectroscopic investigation to determine the type of variability and their astrophysical characteristics.

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MORE FLARES OF HY ANDROMEDAE

The flare star HY And was found by Sharov and Alksnis (1975) on two plates taken on 1973 September 7/8 with the 80 cm Schmidt telescope of the Radioastrophysical Observatory and with the 50 cm Maksutov telescope of the Sternberg Astronomical Institute (Crimean Laboratory).

We inspected about 250 and 1100 plates obtained during 1975–1996 with the Schmidt and the Maksutov telescope, respectively.

On 42 best plates taken with the Schmidt telescope, HY And was identified and its brightness in quiescent state was estimated in the range $B = 19.5 - 20.3$, with the average value $B = 19.9$. The scatter can be attributed to the random error of estimates near the limiting magnitude of the plates used.

The variable in quiescent state is not seen on plates taken with the Maksutov telescope (limiting magnitude $B = 18.5 - 19.5$).

Three more flares of HY And were found. Data on all of them, including slightly revised data for the first one, are listed in Table 1.

Table 1

Date	JD	B
1973 Sep 7-8	2441933.484	18.8
	.505	18.2
	.545	(18.6
1982 Sep 26-27	2445239.310	18.8
1984 Nov 17-18	2446022.344	(19.5
	.377	18.8
1996 Jul 14-15	2450279.490	18.9

For light estimates of HY And, magnitudes of comparison stars based on photoelectric sequences for Nova 30 (Arp, 1956) and for the Field IV of M31 (Baade and Swope, 1963) were used. Equatorial coordinates (from the Schmidt plate taken on JD 2441933.505) and magnitudes of six comparison stars are given in Table 2.

The position of HY And was measured on the same plate and on film copies made from glass copies of POSS O- and E-plates. The coordinates of HY And are $\alpha = 0^{h}39^{m}47\overset{s}{.}87$, $\delta = 41^{\circ}23'49\overset{''}{.}2$ (1950.0, for the mean epoch 1963.7).

Table 2

No.	α_{1950}	δ_{1950}	B
1	$0^{\rm h}9^{\rm m}56\overset{\rm s}{.}10$	$41^\circ 23' 09\overset{''}{.}5$	$17\overset{\rm m}{.}1$
2	0 39 56.68	41 22 29.7	18.0
3	0 39 56.17	41 23 21.9	18.2
4	0 39 53.37	41 24 07.8	18.5
5	0 39 45.86	41 23 09.3	18.9
6	0 39 50.98	41 23 54.0	19.6

The available plates with the images of HY And do not, however, provide reliable proper motion of the star.

Positions of comparison stars given in Table 2 might be useful for future efforts to determine the proper motion of HY And.

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NEW WATER MASER IN L 1251

We report the results of a water maser search carried out with the Effelsberg-100m telescope on Feb. 4 and 7, 1997 in the direction of two IRAS sources in the L1251 (Lynds, 1962) dark cloud. A 300 Jy emission was detected towards IRAS 22376+7455.

We observed the $6_{16} \rightarrow 5_{23}$ (22.23508 GHz) transition of H_2O with a beamwidth of $40''$ during the night of Feb. 4/5, 1997, from 20:00 to 6:00 UTC. A liquid He cooled maser receiver was used with system temperature in the zenith of about 90K. We used the standard 1024 channel autocorrelator with bandwidths of 3.125 MHz and 6.25 MHz. This corresponds to 0.04 and 0.08 kms^{-1} resolution and 41 and 82 kms^{-1} velocity coverage respectively. We observed in the position switching mode with 3 minutes integration time on both the OFF and ON positions and 6 minutes ON and OFF for the high resolution spectra. NGC7027 was used for flux calibration. We adopted 5.86 Jy for its flux density at 22.235 GHz frequency corresponding to 8.2K brightness temperature (see Baars et al. 1977). The measured flux was 0.532 NTU (noise-tube unit), with good pointing.

The IRAS point sources IRAS 22343+7501 and IRAS 22376+7455 were observed on Feb. 4th between 21:00 and 24:00 UTC, and IRAS 22376+7455 was reobserved on Feb. 7th at 8:50 UTC.

IRAS22376+7455 H_2O maser emission was detected towards IRAS 22376+7455. The spectrum (obtained with 3.125 MHZ bandwidth, 6 min. integration time, RMS noise 0.3 Jy) is shown in Figure 1.

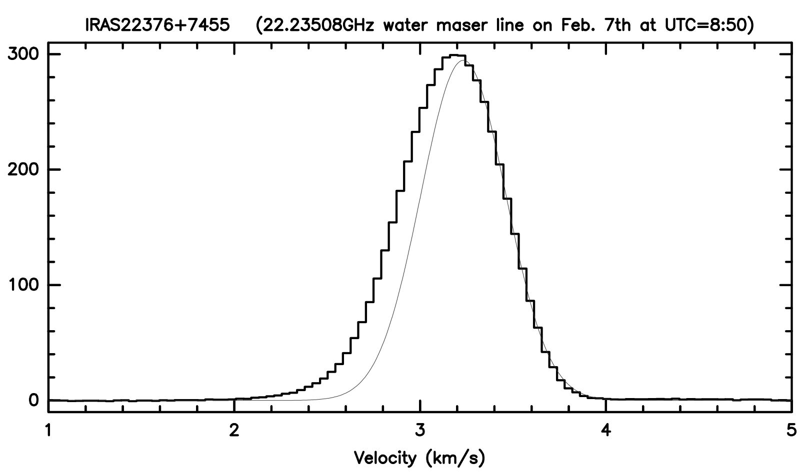

Figure 1. The H_2O $6_{16} \rightarrow 5_{23}$ spectrum of IRAS 22376+7455 (histogram) measured on 1997 Feb. 7 at 8^h50^m UTC with the Effelsberg-100 radiotelescope. The central part of the spectrum is presented as there were no other lines detected in the velocity range [-47 kms^{-1}, $+37$ kms^{-1}]. Gaussian fit to the blue-shifted side is overlaid (thin line). A redshifted excess of $\approx 10\%$ of the total line area is seen.

There is a clear detection of an S =300 Jy line with total line area of W =207 Jykms^{-1}. It appears at a velocity of 3.2 kms^{-1} which is redshifted by about 7 kms^{-1} relative to the rest velocity of the NH_3 cloud core "H2" which is $v_{\rm LSR}({\rm NH}_3 core) = -3.9\,{\rm kms}^{-1}$ (see Tóth & Walmsley, 1996). There is no indication for other lines (i.e. $S > 3\sigma$ peaks) in the velocity range [-47 kms^{-1}, $+37$ kms^{-1}].

The corresponding total luminosity of the maser spot (upper limit, assuming isotropic radiation) is:

$$L_{H_2O} = 6.1 \times 10^{-7} L_\odot \quad ,$$

if we adopt 300 pc for the distance of L1251, as derived by Kun and Prusti (1993) (their value has an uncertainty of $\pm$50 pc). This distance value is in agreement with Balázs' unpublished result being 350$\pm$60 pc. The uncertainty of the luminosity value is $\approx$ 40% which comes from the uncertainty in the distance.

The detected line is slightly asymmetric with a red-shifted wing contributing approximately 10 percent to the total line area. In Figure 1 the observed line is shown (histogram) with the Gaussian fit overlaid (thin line) which was fitted masking out the [2 km/s, 3.2 km/s] velocity range.

We note that the line may also be fitted with two Gaussian components with the following parameters: velocities of 3.11 ± 0.02 kms^{-1}, and 3.35 ± 0.02 kms^{-1}; FWHM of 0.44 ± 0.02 kms^{-1}, and 0.62 ± 0.02 kms^{-1} (correction for instrumental broadening is negligible with 0.04kms^{-1} channelwidth), a peak flux of 245.0 Jy and 97.9 Jy (rms=0.3 Jy), and line area of 161.0$\pm$0.12 Jykms^{-1} and 46.0$\pm$0.05 Jykms^{-1} respectively.

The far-infrared (FIR) colour indices of IRAS 22376+7455 are $\log(F_{25}/F_{12})$=0.842; $\log(F_{60}/F_{25})$= 0.765 and $\log(F_{100}/F_{60})$=0.316 (JISWG, 1989). Its total IRAS flux was calculated according to Emerson (1988) (i.e. $F_{\rm IRAS} = 20.653 \times F(12\mu m) + 7.538 \times F(25\mu m) + 4.578 \times F(60\mu m) + 1.762 \times F(100\mu m)[10^{-14}\,{\rm Wm}^{-2}]$). $F_{\rm IRAS}({\rm IRAS}\,22376 + 7455) = 3.24 \times 10^{-12}{\rm Wm}^{-2}$ which corresponds to $\approx 9.0 L_\odot (\frac{distance}{300pc})^2$ FIR luminosity, assuming isotropic FIR radiation.

FIR colors of both IRAS 22376+7455 and IRAS 22343+7501 are similar to those of other maser sources found in Cepheus by Wouterloot and Walmsley (1986).

Previous water maser observations of IRAS 22376+7455 were unsuccessful according to:

- Felli et al. (1992): $F < 2.8$ Jy in Feb. 1990,
- Tóth & Walmsley (1994): $F < 0.3$ Jy in Oct. 1993,
- Claussen et al. (1996): $F < 0.1$ Jy, regularly observed from Dec. 1991 to Oct. 1994.

Three HH objects were found in association with IRAS 22376+7455 by Eiroa et al. (1994). Near-infrared (K band) observations of the point source by Hodapp (1994) indicated a cluster of point sources there, the reddest one among them is possibly driving a CO outflow (Sato et al., 1994) associated with the IRAS point source.

IRAS 22376+7455 is one of the faintest IRAS point sources with detected water maser emission (see e.g. Wilking et al., 1994), and its water maser flux is relatively high as compared to the other known examples. The $L_{\rm H_2O} = 1.12 \times 10^{-9} (L_{\rm FIR})^{1.02}$ empirical relation of Felli et al. (1992) predicts $L_{\rm H_2O} = 1.1 \times 10^{-8} L_\odot$.

The maser emission may originate in the shocked clumps near the driving source of the outflow. Interferometric observations of this source with the aim at determining a precise position would help further interpretation.

IRAS 22343+7501 showed no water maser emission during our observations with a detection limit of 0.3 Jy (3 times the $T_{\rm RMS}$) in the velocity interval $-45\,{\rm kms}^{-1} < v_{\rm LSR} < +35\,{\rm kms}^{-1}$. Water maser emission of IRAS 22343+7501 was first detected by Wilking et al. (1994) in Jan. 1992. From Claussen et al. (1996) (see their Fig. 13) and from the detection by Tóth & Walmsley (1994) in Oct. 1993 we may assume the maser source can be seen at least once in a "quasi-period" of ≈ 5 months.

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ERRATUM

Dr. G. Williams has revealed a misprint in the 73rd Name-List of newly designated variable stars (IBVS No. 4471). In the introductory part, when listing mistakes in the earlier Name-Lists, V353 Pup was claimed to be NSV 03431. The correct cross-identification is, however, V353 Pup = NSV 03731.

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OPTICAL OBSERVATIONS OF THE STAR RX J1239.8+5511

The sky was surveyed in the X-ray region of the spectrum by the ROSAT satellite (Voges et al., 1997) and catalogs of the sources included RX J1239.8+5511 = GSC 3844_317 (Jenkner et al., 1990).

The automated 0.5-m. telescope, Cousins R filter and CCD camera of the Climenhaga Observatory of the University of Victoria (Robb and Honkanen, 1992) were used to make photometric observations of RX J1239.8+5511. Using IRAF [1] routines the frames were de-biased and flat fielded, and the magnitudes were found from 6 arc second aperture photometry after using the Gaussian centering option of the PHOT package.

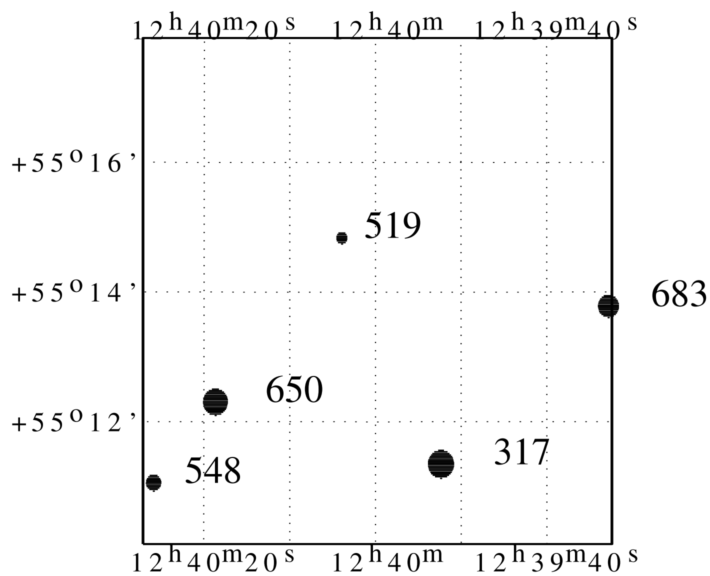

Figure 1. Finder chart of the field labeled with the GSC numbers (Jenkner et al., 1990)

The field of stars is shown in Figure 1, and their designations, coordinates (J2000) and magnitudes from the Hubble Space Telescope Guide Star Catalog (GSC) (Jenkner et al., 1990) are given in Table 1. To look for brightness variations during a night the standard deviation of the differential magnitudes for each star during a night were calculated and ranged from $0^{m}_{.}004$ for a bright star on a good night to $0^{m}_{.}030$ for the faint stars on poor nights. To measure night to night variations a run mean of the fourteen nightly averages was calculated and is shown in Table 1 as ΔR in the sense the star minus GSC 3844_650. We consider GSC 3844_317 to be the only significantly variable star. Due to the small field of view extinction effects were negligible and no corrections have been made for them. No corrections have been made to transform the R magnitude to a standard system.

[1] IRAF is distributed by National Optical Astronomy Observatories, which is operated by the Association of Universities for Research in Astronomy, Inc., under contract to the National Science Foundation

Table 1. Stars observed in the field of RX J1239.8+5511

GSC No.	RA J2000.	Dec. J2000.	GSC Mag.	Δ R Mag.	V	$(R-I)_C$
3844_317	$12^h39^m52^s$	$+55^o11'21''$	10.9	variable	11.77	0.66
3844_650	$12^h40^m19^s$	$+55^o12'18''$	11.3	-	11.71	0.35
3844_683	$12^h39^m33^s$	$+55^o13'47''$	12.4	$+1.003 \pm .015$	12.92	0.35
3844_519	$12^h40^m04^s$	$+55^o14'50''$	15.3	$+3.701 \pm .058$	-	-
3844_548	$12^h40^m26^s$	$+55^o11'03''$	14.1	$+2.806 \pm .051$	-	-

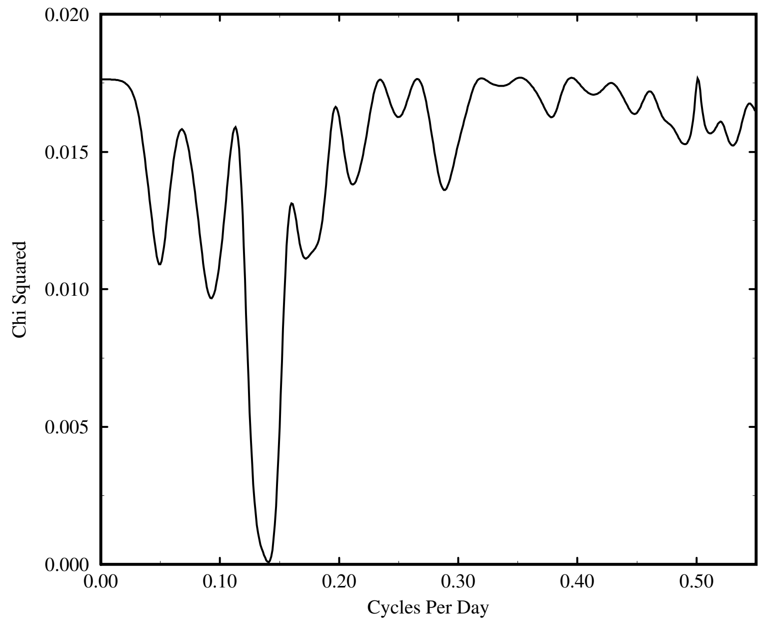

Figure 2. Period search of the nightly means of RX1239.8+5511.

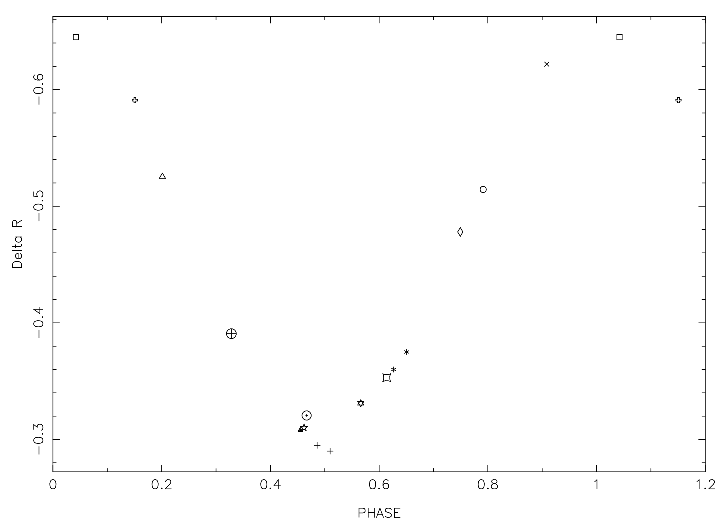

Figure 3. R band light curve of RX J1239.8+5511 for 1997

Brightness variations in RX J1239.8+5511 were barely detectable during a night, but were obvious from night to night. A sine curve was fit to the nightly means and the χ^2 for various periods is shown graphically in Figure 2. The best fit was found for a frequency of 0.1407 cycles per day and semi-amplitude of $0\overset{m}{.}174$. This gives the ephemeris:

$$\text{HJD of Maxima} = 2450583\overset{d}{.}4(3) + 7\overset{d}{.}1(4) \times \text{E}.$$

where the uncertainty in the final digit is given in brackets. A plot of the nightly mean differential (GSC 3844_317−3844_650) R magnitudes phased at this period is shown in Figure 3 with different symbols for each of the different nights.

To help classify the variable star B, V, R and I frames were obtained under photometric conditions (JD 2450608) along with observations of the nearby bright standard stars HR 4660, HR 4716, HR 4931 and HR 5154 (Moffett and Barnes, 1979). The V magnitudes and $(R-I)_C$ colors are listed in Table 1 for the three brightest stars. The random errors for these data are about $0\overset{m}{.}03$. However great caution should be exercised in using these data since they are derived from only a few standard stars and their (R−I) was transformed from the Johnson system to the Cousins system using the equations of Taylor (1986). While certainly not definitive these colors confirm that RX J1239.8+5511 is a late type (approximately K4) star (Cousins 1981). From the admittedly poorly determined (B−V) of $0\overset{m}{.}8 \pm 0\overset{m}{.}1$ RX J1239+5511 is more likely a dwarf and not a giant star. Assuming an absolute magnitude of $7\overset{m}{.}0$ (Allen 1976) we find a distance of approximately 90 parsecs.

From the shape and amplitude of the light curve and the length of the period we would expect that this is a single K4V star with spots and X-rays produced by an active corona. It is possible that this star is a giant with spots or with a close companion either heating one hemisphere or causing a tidal distortion. To eliminate this possibility further photometric observations are useful to look for variations in color or in the height of the maxima. Spectral observations would be helpful to determine the spectral type, to look for Ca H&K emission, to determine $v\,sin(i)$ and to look for radial velocity variations.

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THE RECENT OPTICAL DECLINE OF V1057 Cyg

The pre-main sequence star V1057 Cyg was discovered as the second FU Orionis variable in 1970 (Herbig 1977). The star brightened by ~ 5 mag in less than one year and reached B ~ 10 in 1972 (see Figure 1). The optical spectrum also changed significantly, evolving from a T Tauri-like spectrum into an A-type supergiant with P Cyg-type emission lines. The star also developed large near-infrared and near-ultraviolet excesses over the spectral energy distribution expected for a normal supergiant. The large broadening of optical absorption lines further indicated significant rotation, in excess of 30–40 km s^{-1} at 0.5–0.6 μm.

Following the eruption, the brightness and spectrum continued to evolve. The spectrum cooled from an A-type to an F-type to a G-type supergiant in roughly a decade. The optical brightness declined by nearly a factor of ten during this time and then leveled off at B ≈ 13. The system also declined at all other wavelengths. The magnitude of the decline decreased monotonically from 4 mag at 0.36 μm to 0.5 mag at 3–5 μm. Kenyon & Hartmann (1991) interpreted this evolution in terms of a changing color temperature of a central accretion disc surrounding a low mass pre-main sequence star. Larger declines at wavelengths exceeding 5 μm followed the overall decline in bolometric luminosity of the optical source. This radiation is optical light absorbed and reradiated by a surrounding dust cloud (see Kenyon & Hartmann 1991).

During the past decade, we have acquired UBV photometry of V1057 Cyg to follow the continuing decline of this interesting system. We acquired these data with the 60-cm Zeiss reflector at the Crimean Laboratory of the Sternberg State Astronomical Institute (see Kolotilov 1990; Kenyon et al., 1991). Most observations were made through a $13''$ aperture; a $27''$ aperture was used on nights of poor seeing. We reduced the data using Landolt's (1975) star N9 as the comparison and star N13 as the control. The probable errors are ± 0.01–0.02 mag in V and ± 0.02–0.03 mag in B–V.

Figures 1-2 show our B light curves. The complete light curve in Figure 1 illustrates the ~ 1 mag irregular variability prior to the eruption, the 5 mag rise itself, a roughly 15 yr decline (~ 0.2 mag yr^{-1}), a nearly 10 yr period of constant brightness, and the recent, relatively rapid, decline of nearly 2 mag (see also Kenyon & Hartmann 1991 and references therein). The optical source varies irregularly, ~ 0.1–0.3 mag, on time scales of days to weeks throughout the optical decline. The amplitude of these irregular variations increases towards blue wavelengths and may reach ~ 0.5 mag at U (Kolotilov 1990; Kopatskaya 1984).

Figure 2 shows the recent activity on an expanded scale. The system declined ~ 1 mag in 8–10 months, recovered by ~ 0.25 mag in 1 yr, and then faded by ~ 0.75 mag in the past year. The B–V color increased by $\delta(B-V) \approx 0.35$ mag as the optical brightness declined. The B–V color changed very little during the increase in B brightness during Year 27 (compare Figures 2 and 3).

In addition to the obvious decline, the B light curve contains a wave-like fluctuation with a period of $\sim$ 2 yr and an amplitude of $\sim$ 0.5 mag. This variation was *not* visible shortly after maximum and has developed in the past decade. The variation maintained its 'coherence' through approximately one cycle during the recent 1.5 mag decline. Future data will yield better estimates for the period and amplitude of this variation.

The recent evolution of the light curve, with a total decline of 1.5 mag in nearly 3 yr, resembles the rapid fading of V1515 Cyg in the 1980's (Kenyon et al. 1991). The evolution of V1515 Cyg was comparable in magnitude but slightly faster, with a decline of $\sim$ 1.5 mag in slightly less than one year. The change in the B–V color was identical in both systems. Neither system showed much spectroscopic evolution during the decline: both continued to show G-type absorption features at minimum light.

The simplest explanation for the optical minimum in V1057 Cyg is a dust condensation event in the outflowing wind from the inner accretion disc. Kenyon et al. (1991) showed that the decline of V1515 Cyg can be explained with this interpretation. In V1057 Cyg, the reddening of the B–V color is consistent with a 1.5 mag decline in B brightness for a standard extinction law (Mathis 1990). The lack of significant changes on optical spectra of V1057 Cyg suggests an external event – rather than a sudden cooling of the central source – caused the brightness decline.

Future optical photometry will provide a test of this simple picture. The brightness of V1515 Cyg recovered from the 1.5 mag decline in several years. We expect a similar time scale for recovery in V1057 Cyg once it has reached a definite minimum.

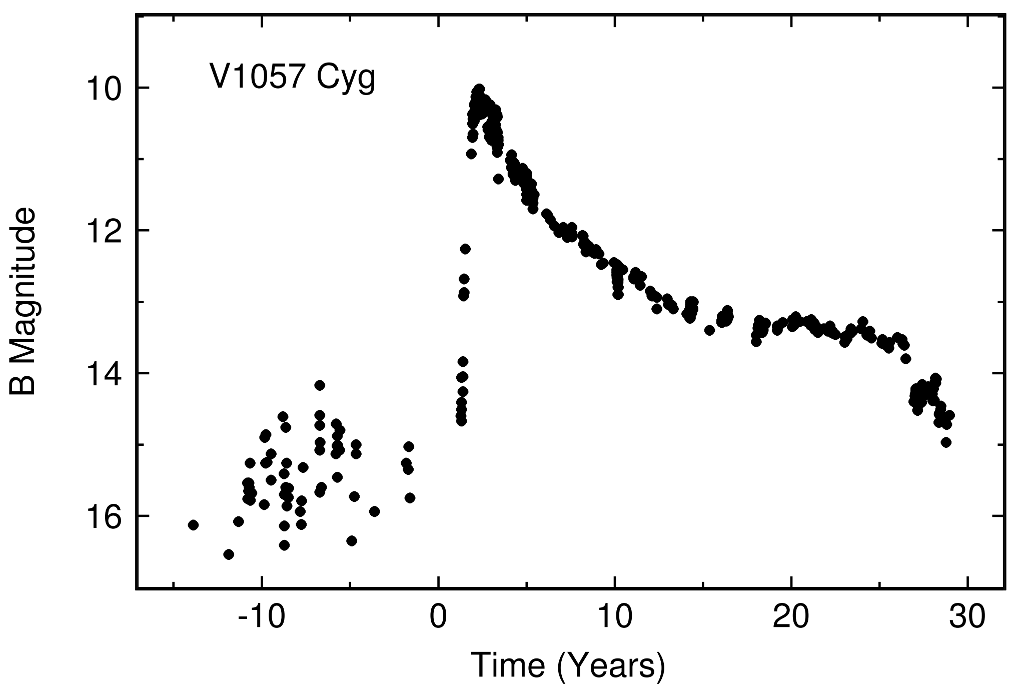

Figure 1. Historical B light curve of V1057 Cyg

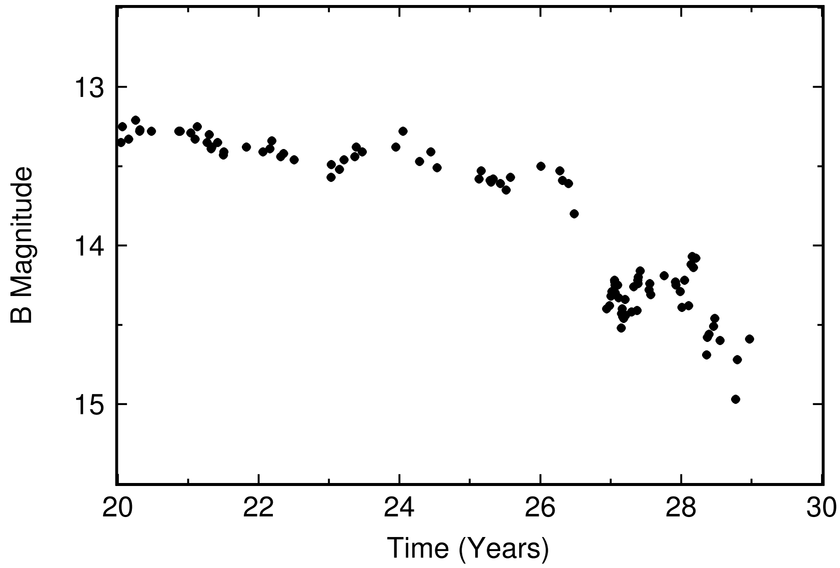

Figure 2. Recent B light curve of V1057 Cyg

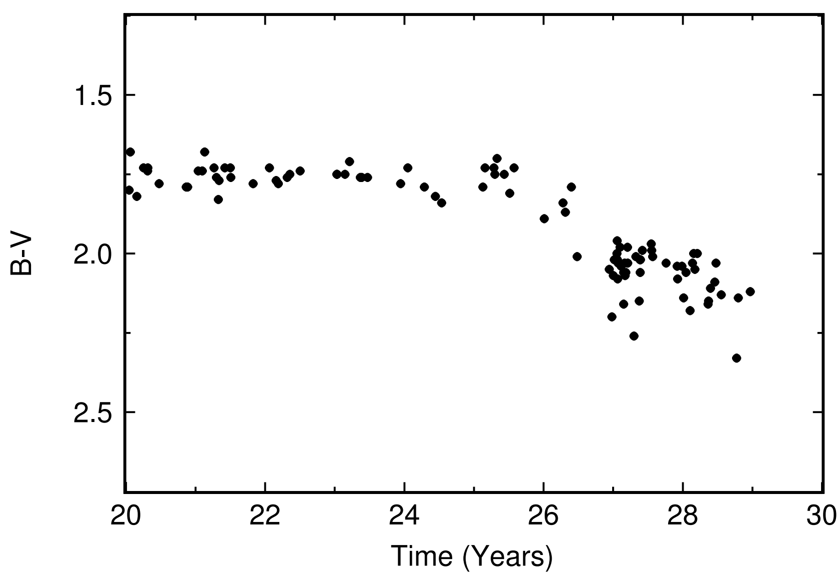

Figure 3. Recent B–V evolution of V1057 Cyg

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PHOTOMETRIC PECULIARITIES OF CH Cyg DURING ITS RECENT, 1995-97, QUIESCENT PHASE

CH Cyg is a peculiar symbiotic star. A high level of variability in all the observed parameters makes it very difficult to understand. A single-star model had been accepted by some authors until the 1980's, when a regular variation in radial velocities of about 5 700 days was revealed, and the binary nature for CH Cyg was suggested (Yamashita and Maehara 1979). However, explanation of the total hot component luminosity during the 1981-84 maximum in such a wide binary appeared to be a crucial problem. Skopal (1988) tried to solve this problem by assuming an asynchronous rotation of the giant star in the long-period binary to get a larger mass transfer via the L_1 point. On the other hand, Mikolajewski and Mikolajewska (1988) suggested a long-term accumulation of the wind material around a rapidly rotating magnetic white dwarf before its final accretion at a high rate. A new track in the investigation of the nature of CH Cyg was set by Hinkle et al. (1993) who suggested a triple-star model in which an unseen G-K dwarf on the long 14.5-year period orbit revolves the inner binary (the symbiotic pair) as the short 756-day period component. Skopal et al. (1996a) supported the triple-star model giving, however, two main modifications of the previous suggestion. They showed that CH Cyg is the system with a very high inclination of both the orbits, and instead of the unseen G-K dwarf, there is another giant star in the system on the long-period orbit. Also multifrequency observations from ultraviolet to the radio/mm-wave region, carried out during the recent 1992-94 active phase, revealed that outbursts can arise from accretion of material from the giant component onto its companion in the symbiotic pair of the triple CH Cyg system (Skopal et al. 1996b). In this contribution we present the recent development in its UBVR light curves.

CH Cyg has been regularly monitored at the Skalnaté Pleso (SP) and Stará Lesná (SL) observatories. The observations have been made in the standard Johnson system using a one-channel photoelectric photometer installed in the Cassegrain focus of the 0.6/7.5 m reflectors. The stars HD 182 691 (V=6.525, B−V=−0.078, U−B=−0.24, V−R=0) and SAO 048 428 (m_v=8.0, m_{pg}=8.6, spectrum F8) were used as the comparison and the check stars, respectively.

Our new UBVR photometric observations are introduced in Table 1 and plotted in right panels of Figure 1 together with those published previously in the literature. They cover a period of the CH Cyg return to quiescence from its recent, 1992-95, active phase. Here we point two peculiarities which developed during this period: (i) a sudden drop in the U brightness by ∼1.5 mag at about JD 2 450 260 – marked in Figure by a bar, and (ii) about 1 mag deep and ∼200 days broad minimum centered around JD 2 450 310 (1996 August), and pronounced more in V and R.

Table 1. New photometric observations of CH Cyg

JD−2 440 000	U	B	V	R	Date	Obs
10070.291	10.314	10.314	8.710	6.734	18/12/95	SP
10080.188	10.553	10.357	8.637		28/12/95	SL
10096.191	10.953	10.319	8.483		13/01/96	SL
10099.190	10.553	10.232	8.458		16/01/96	SL
10115.633	10.465	10.117	8.504	6.558	01/02/96	SP
10139.613	10.572	10.349	8.841	6.849	25/02/96	SP
10150.607	10.510	10.336	8.869	6.869	07/03/96	SP
10160.502	10.649	10.467	8.987	6.937	17/03/96	SP
10161.531	10.414	10.397	8.966	6.948	18/03/96	SP
10193.539	10.538	10.389	8.885	6.960	19/04/96	SP
10197.487	10.898	10.508	8.959	7.008	23/04/96	SP
10234.411	11.285	11.121	9.660	7.536	30/05/96	SP
10240.469	11.174	11.130	9.752	7.611	5/06/96	SP
10248.470	11.478	11.358	9.921	7.749	13/06/96	SP
10269.371		11.725	10.063	7.859	4/07/96	SP
10274.478	11.425	11.473	10.070	7.847	9/07/96	SP
10278.492			10.183	7.829	13/07/96	SP
10286.448	11.116	11.306	9.948	7.756	21/07/96	SP
10292.373	11.159	11.329	9.939	7.746	27/07/96	SP
10296.455	10.858	11.173	9.888	7.726	31/07/96	SP
10305.477	10.869	11.213	9.953	7.793	09/08/96	SP
10364.462	11.393	11.394	9.882	7.649	07/10/96	SP
10365.373	11.365	11.377	9.883	7.656	08/10/96	SP
10371.231	11.600	11.624	9.947		14/10/96	SL
10383.208	11.476	11.522	9.929	7.651	26/10/96	SP
10384.207	11.680	11.628	9.956		27/10/96	SL
10397.256	11.339	11.428	9.908		09/11/96	SL
10411.193	10.803	11.004	9.642	7.457	23/11/96	SP
10421.247	10.931	10.963	9.452	7.313	03/12/96	SP
10421.290	10.968		9.453	7.294	03/12/96	SP
10422.209	11.162	11.157	9.492		04/12/96	SL
10425.192	11.232	11.191	9.471		07/12/96	SL
10428.263	11.069	10.957	9.375	7.230	10/12/96	SP
10445.261	11.044	10.864	9.292	7.127	27/12/96	SP
10456.217	11.292	11.029	9.384	7.177	07/01/97	SP
10467.676	10.779	10.811	9.310	7.162	18/01/97	SP
10482.555	10.737	10.721	9.203	7.034	02/02/97	SP
10509.467	10.759	10.733	9.209	7.006	01/03/97	SP
10519.551	10.895	10.852	9.282	7.068	11/03/97	SP

The first event is probably caused by cessation of the mass accretion onto the active star in the system, indicating thus the end of the recent, 1992-95, active phase. After this, between approximately JD 2 449 900 and JD 2 450 100, the color indices did not differ from those of a typical late-type giant, which supports the above mentioned idea. A rival interpretation – a dust condensation in the circumstellar envelope of CH Cyg – should be tested by the infrared/radio observations, which, however, are not available at present time.

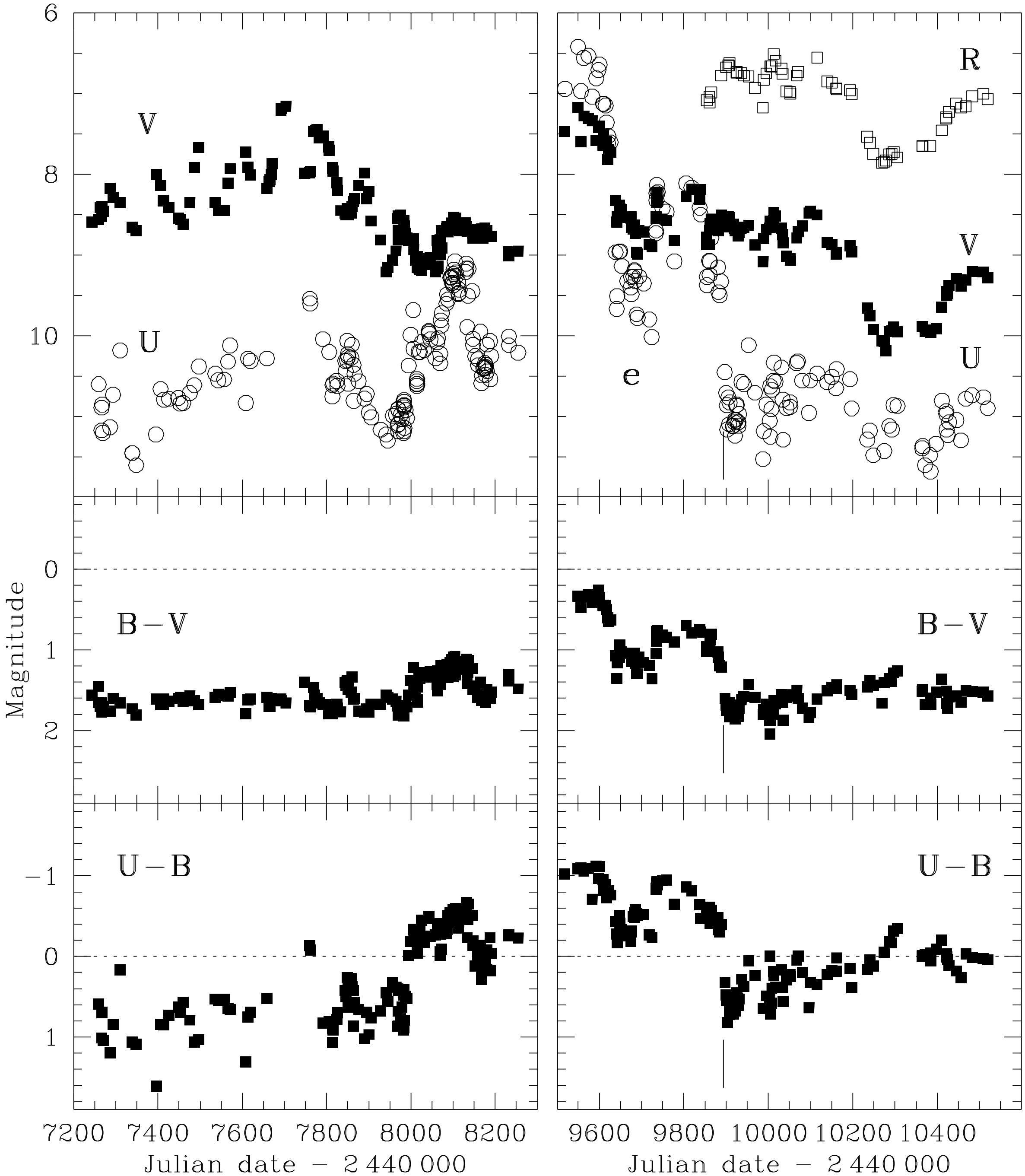

Figure 1. Right: recent UBVR photometry of CH Cyg covering its return to quiescence. The end of the active phase is marked by a bar. The eclipse in the symbiotic pair of the triple-star system is marked by **e**. Left: a part of the light curve during the previous, 1987-91, quiescent phase. It displays variations in V similar to those recently observed

The second phenomenon – the deep minimum – is characterized by a change in the U−B index to ≤ 0. Prior to this minimum, the M giant's $\sim$100-day pulsations were seen well in the V, R light curves. A similar behaviour was recorded during the previous, 1987-91, quiescent phase (see left panels of Figure 1), during which a series of $\sim$100-day pulses of the giant star was also ended by a more pronounced minimum in the V band around JD 2 448 030 (1990 May). Here we note that only the giant star in the symbiotic pair of the triple CH Cyg system is responsible for the observed $\sim$100-day variations (Skopal, in preparation). In addition, spectroscopic observations made during these two minima, in 1990 and 1996, show a similar change in the cool continuum – a significant smoothing of the TiO bands (cf. Figure 6 of Bode et al. 1991 and Figure 3 of Mikolajewski et al. 1996). According to these observations and a detailed discussion on the 1990 minimum by Taranova and Yudin (1992), we can generally see the nature of the deep minimum in the giant's intrinsic variability rather than in a new dust creation. However, multifrequency observations are strongly needed to understand better the real nature of such the minima in the light curve of CH Cyg.

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OBSERVATION OF THE OPTICAL COUNTERPART OF THE GRB 970508 SOURCE

With the aid of the 60/90/180 cm Schmidt telescope of the Konkoly Observatory we obtained CCD images of the gamma ray source which was detected by the BeppoSAX Gamma-Ray Burst Monitor on May 8.904 UT, 1997. We used a Photometrics, AT200 CCD camera having a 1536 x 1024 pixel KAF 1600 MCII coated CCD chip displaying a 29 arcminute x 18 arcminute area of the sky with an angular resolution of nearly 1 arcsecond/pixel. The images were taken on the nights 15/16 May 1997 (5 frames each 10 minutes exp. time) and 31 May/01 June 1997 (6 frames each 15 minutes exp. time).

In order to reduce the background noise and to reach as faint limiting magnitude as possible we coadded the frames taken on one particular night (Figure 1 and Figure 2). Filters were not used for the imaging. Based on the spectral sensitivity distribution of the chip, the brightness values represent close to R magnitudes. To estimate the brightness of the optical counterpart of the GRB 970508 we compared its intensity to the nearby star 13 arcsec north, R=19.7 (Schaefer et al., 1997) marked as "c" in Figures 1 and 2.

During our observations we made positive identification of the source on the night 15/16 May 1997 and a negative one on the night 31 May/01 June 1997, which means that we could not identify any visible object in the previous position of the optical counterpart imaged two weeks before. Because the limiting magnitude of our coadded frame was 23.5 $\pm$ 0.2 magnitude we conclude that the object has faded below this brightness level.

The light curve based on the data listed in Table 1 is shown in Figure 3.

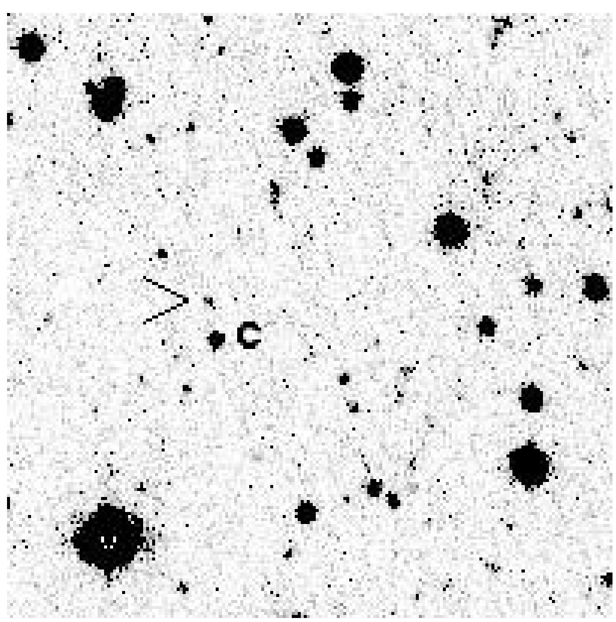

Figure 1. CCD image of the optical counterpart of the GRB 970508. Date of the exposure for the coadded image is 15.994 May 1997 (J.D. 2450584.494)

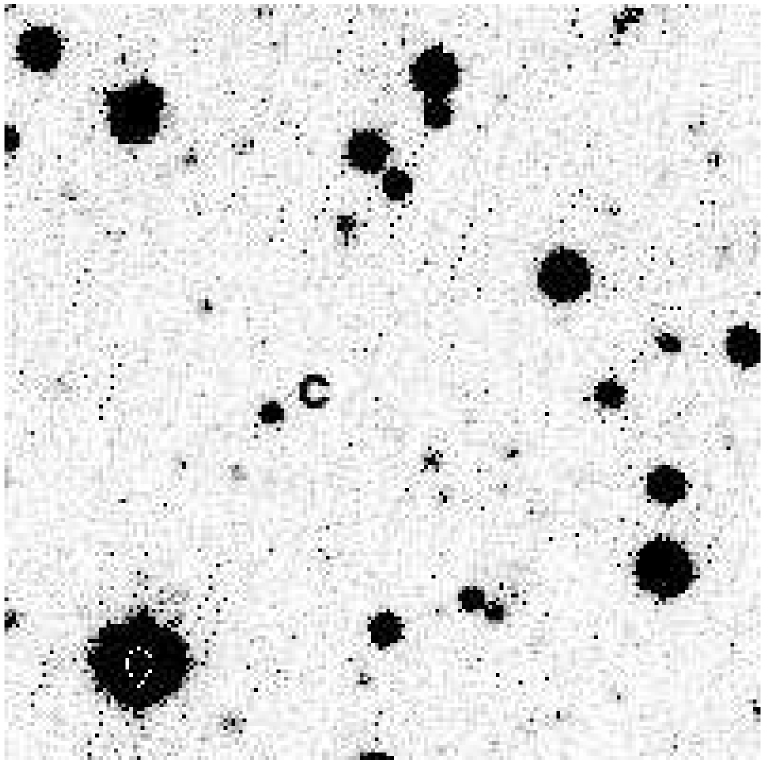

Figure 2. CCD image of the optical counterpart of the GRB 970508. Date of the exposure for the coadded image is 01.001 Jun. 1997 (J.D. 2450600.501)

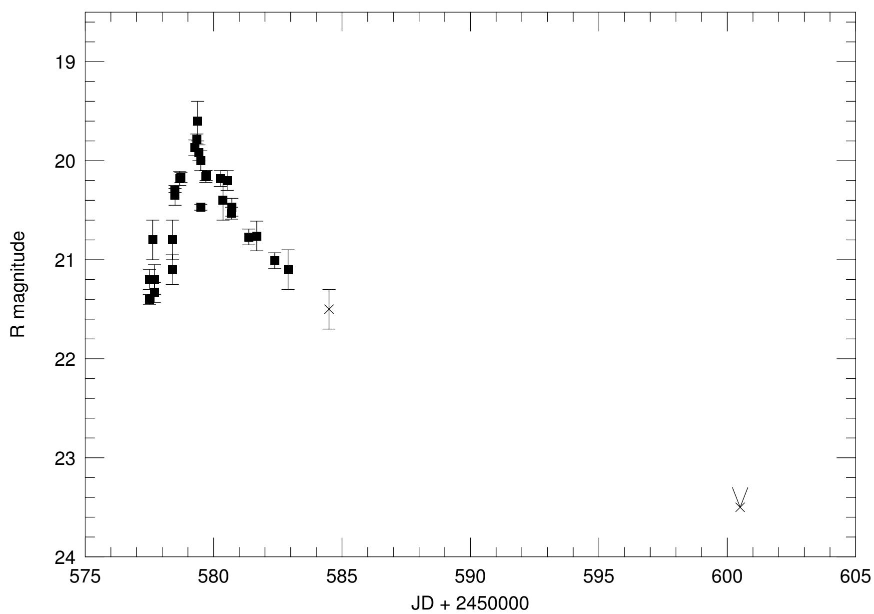

Figure 3. R lightcurve of the optical counterpart of the GRB 970508 based on the brightness data published in the IAU Circulars (see References). The x represents the brightness estimation made at the Konkoly Observatory

Table 1. Brightness data of the GRB 970508 in the R band

Date UT. (1997 May)	J.D. 2450000+	m(R)	err.	source
09	577.500	21.2	.1	Galama et al., 1997
09	577.500	21.4	.05	Schaefer et al., 1997
09.128	577.628	20.8	.2	Castro-Tirado et al., 1997
09.19	577.690 (Gunn r)	21.33	.1	Djorgovski et al., 1997a
09.195	577.695 (Gunn r)	21.2	.15	Djorgovski et al., 1997b
09.89	578.390	21.1	.15	Kopylov et al., 1997
09.899	578.399	20.8	.2	Castro-Tirado et al., 1997
10	578.500	20.3	.02	Schaefer et al., 1997
10	578.500	20.35	.1	Galama et al., 1997
10.178	578.678 (Gunn r)	20.18	.07	Djorgovski et al., 1997b
10.23	578.730 (Gunn r)	20.17	.05	Djorgovski et al., 1997a
10.77	579.270	19.87	.08	Kopylov et al., 1997
10.85	579.350	19.78	.05	Mignoli et al., 1997
10.872	579.372	19.6	.2	Castro-Tirado et al., 1997
10.93	579.430	19.92	.08	Kopylov et al., 1997
11	579.500	20.0	.1	Galama et al., 1997
11	579.500	20.47	.03	Schaefer et al., 1997
11.198	579.698 (Gunn r)	20.16	.06	Djorgovski et al., 1997b
11.21	579.710 (Gunn r)	20.15	.05	Djorgovski et al., 1997a
11.76	580.260	20.18	.08	Kopylov et al., 1997
11.868	580.368	20.4	.2	Castro-Tirado et al., 1997
12.03	580.530	20.2	.1	Groot et al., 1997
12.195	580.695 (Gunn r)	20.53	.06	Djorgovski et al., 1997b
12.21	580.710	20.47	.09	Garcia et al., 1997
12.87	581.370	20.77	.08	Kopylov et al., 1997
13.18	581.680 (Gunn r)	20.76	.15	Djorgovski et al., 1997c
13.88	582.380	21.01	.08	Kopylov et al., 1997
14.40	582.900	21.1	.2	Chevalier et al., 1997
15.99	584.494	21.5	.2	present paper
Jun 1.00	600.501	23.5	.2	present paper (upper limit)

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Galama, T.J. et al., 1997, *IAU Circular*, No. 6655
Garcia, M. et al., 1997, *IAU Circular*, No. 6661
Groot, P.J. et al., 1997, *IAU Circular*, No. 6660
Kopylov, A.I. et al., 1997, *IAU Circular*, No. 6663
Mignoli, M. et al., 1997, *IAU Circular*, No. 6661
Schaefer, B. et al., 1997, *IAU Circular*, No. 6658

CORRIGENDA

Correction to IBVS No. 4418: In order to bring to accordance Table 1 and Figure 2, it is necessary to interchange star's Nos. 4 and 5 in Table 1 and to attribute No. 6 to that one of two stars with number 5 in Figure 2 that has coordinates Xpixel=359 and Ypixel=341.

Y. Malakhova

The eclipsing binary nature of NSV 07457 (see IBVS No. 4365) was discovered earlier by J. Vandenbroere (IBVS No. 3946), see also Diethelm's note published in IBVS No. 4011.

The Editors

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MULTIPERIODICITY OF THE δ SCUTI STAR BR CANCRI

BR Cancri (=HD 73175=SAO 97975, also known as KW 45 in Praesepe cluster) was discovered as a δ Scuti star by Breger (1973) on the basis of several-hour-long observations. It pulsates with a period of 0.038±0.005 days. The author found no more data available in the literature. For checking its variability, observations covering a total of ten nights were secured between February 14 and March 30 1997. The observations were carried out by using a three-channel high-speed photometer P45-A attached to a 85cm reflector of Xinglong Station of Beijing Astronomical Observatory, China. The photometer is especially used in WET, the Whole Earth Telescope network (Nather et al., 1990). The comparison star ($RA = 08^{\rm h}38^{\rm m}32\overset{\rm s}{.}17, Dec = 19°27'54''.5, 2000.0, 10.2V$) used was chosen carefully. No variation was found in its brightness. Furthermore, the constancy of comparison star was independently inspected with another star ($RA = 08^{\rm h}37^{\rm m}38\overset{\rm s}{.}10, Dec = 19°31'06''$, 2000.0, 11.5V) in one night. The data were acquired as continuous 10s exposures through Johnson's V filter. The data were corrected for the sky background contribution and the atmospheric extinction. In order to analyze pulsational frequencies, all the measurements were binned into 120s integrations by taking 12-point averages and the times of measurements of BR Cnc were converted into HJD. This way 684 datapoints were obtained. The characteristics of the light curve of BR Cnc is shown schematically in Figure 1 according to the high-time-resolution photoelectric photometry. The brightness variation appears to be multi-periodic.

After the application of consecutive prewhitening procedure and frequency analysis, at least 3 frequencies were resolved through a standard Fourier program Period (Breger 1990). Figure 2 displays the preliminary power spectra of three apparently exhibited

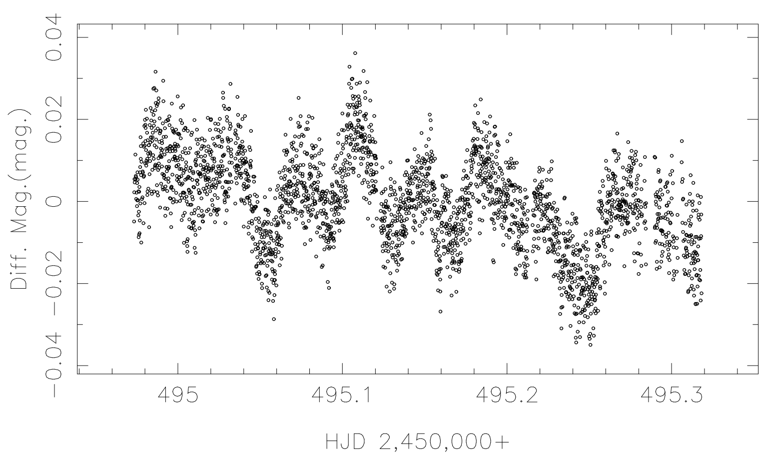

Figure 1. One of the typical high-time-resolution V light curves of BR Cnc observed on February 16 1997. Exposure time of each point is 10s

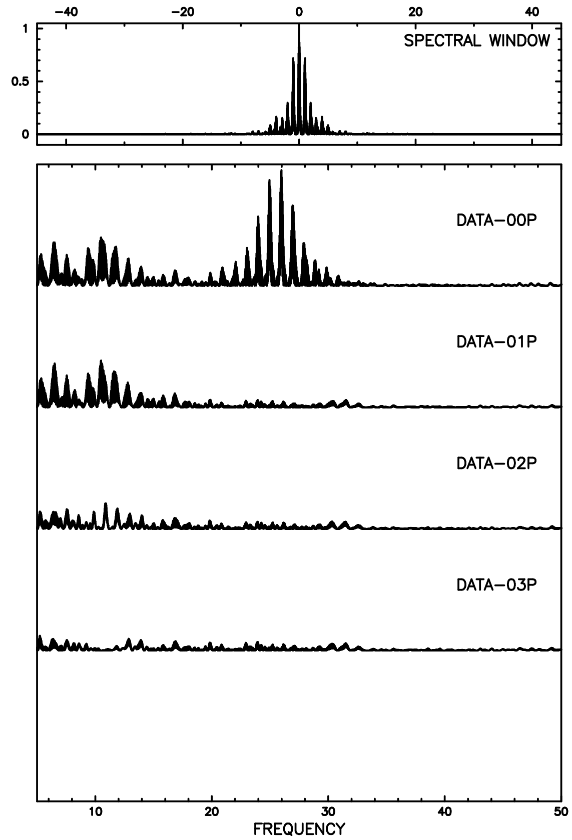

Figure 2. The spectral window (in top panel) and power spectra of three suggested frequencies of BR Cnc. The fundamental frequency 26.0023 c/d is displayed in the second panel; the third and fourth panels correspond to 10.4776 and 10.8994 c/d respectively. Note that different ordinates were used: for the DATA-00P (f_1), ordinate goes up to 1.45×10^{-5} mag from the origin; for DATA-01P (f_2), ordinate goes from 0 to 6.0×10^{-6}; for DATA-02P (f_3), the peak value is just 3.2×10^{-6} power of mag; the bottom panel shows the power of the residuals of the fitting with 3 frequencies above. Abscissa in cycles/day

frequencies: f_1=26.0023, f_2=10.4776 and f_3=10.8994 cycles/day with a standard error of 0.007. The peaks at frequencies f_2 and f_3 could be influenced by a 1 c/d aliasing which can be seen from the spectral window. In view of the relatively short coverage the pulsational nature of this low amplitude δ Sct star deserves further investigation.

I would like to thank Dr. Li Zhiping for valuable suggestion which greatly inspired me in the analysis of the observational data. This research was granted by the National Science Foundation of China.

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IMPROVED POSITIONS FOR SONNEBERG VARIABLES; PART 2

This paper is the second one devoted to the position improvements for Sonneberg variables, with more details given in Mánek (1997).

Table 1 gives precise positions for objects having published finding charts in MVS 250 – 254 (1957). North on these charts is on the top with exceptions marked directly on individual charts. However there are deviations from this rule and these are noted in remarks. Comments from original papers of Hoffmeister (1931, 1934) were used when possible. The source of the position is coded as follows : A = A1.0, C = CCD, D = DSS+Fitsview, E = estimate, P = plate scan. Positions should be precise to $\pm$ 1″ for A, C, P code and to $\pm$ 2″ for D code. The possible error for E code is noted in remarks. Identification with GSC is given where possible. No other identifications were searched for. As the final designation does not appear on the charts (it was not known at the time when charts were published), provisional designation is given in the table too. The differences resulting from a comparison with the positions given in GCVS in the sense ($new - GCVS$) are also shown, where $\Delta\alpha$ is given in seconds of time and $\Delta\delta$ is given in minutes of arc.

Table 1

Prov. desig.	Name	RA (2000)	Dec	GSC	s	$\Delta\alpha$	$\Delta\delta$	Remark
267.1931	V511 Oph	18 08 19.24	+2 25 30.8	0435.4321	A	−0.8	0.0	
268.1931	V494 Oph	18 08 22.19	+3 12 05.0	0435.1299	A	+1.1	+0.6	
269.1931	V575 Oph	18 08 51.20	+3 31 52.7	0435.0847	A	−0.5	−0.2	
270.1931	V495 Oph	18 09 04.56	+3 29 29.7		A	−4.2	−1.1	
271.1931	V496 Oph	18 10 14.61	+3 08 42.7	0435.1931	A	−0.6	+0.1	
272.1931	V497 Oph	18 10 56.27	+3 13 02.2	0435.1599	A	+5.2	+0.3	
273.1931	AZ Ser	18 14 50.95	−0 13 17.5	5097.0855	A	−0.1	−0.3	
274.1931	BB Ser	18 15 39.45	−0 13 09.3		A	+1.3	+0.8	
275.1931	V498 Oph	18 15 44.11	+0 05 20.4	0432.0726	A	+0.4	−1.7	
276.1931	V499 Oph	18 16 48.53	+2 26 39.7		A	−1.4	−1.5	
277.1931	V500 Oph	18 17 59.49	+2 15 52.3		A	−2.7	+0.6	
278.1931	V348 Aql	19 11 20.00	+0 29 11.7	0463.2661	A	+1.7	+0.2	
279.1931	V352 Aql	19 13 33.74	+2 18 13.0		A	−4.6	0.0	2
280.1931	V353 Aql	19 15 18.12	+5 03 06.0	0472.2097	A	+3.9	−1.2	
281.1931	V355 Aql	19 17 13.39	+0 56 27.8		A	+1.5	+1.0	
282.1931	V848 Aql	19 20 34.36	+3 03 00.0	0468.2841	A	+0.8	−0.7	
283.1931	V531 Aql	19 22 50.30	+6 14 19.4	0477.4022	A	−3.7	−1.5	
284.1931	V372 Aql	19 29 17.20	+3 14 30.2	0469.2592	A	+7.8	+0.3	
285.1931	V376 Aql	19 30 51.06	+3 16 57.6	0482.0576	A	−0.3	+0.6	
286.1931	V416 Aql	19 33 39.51	+0 32 22.8	0478.0495	A	−2.8	−0.2	
287.1931	V391 Aql	19 37 52.55	+6 43 44.1	0491.0030	A	−0.1	−1.7	
288.1931	V392 Aql	19 38 33.79	−0 31 34.8	5145.0506	A	+1.3	+1.5	
289.1931	LT Aql	19 38 49.75	+6 34 59.3		A	+1.9	−1.5	
290.1931	V398 Aql	19 40 26.99	+5 06 44.2		A	−5.5	−1.3	
291.1931	UY Sge	20 20 23.39	+16 36 48.8	1631.1551	A	−0.1	−1.7	

Table 1 (continued)

Prov. desig.	Name	RA (2000)	Dec	GSC	s	Δα	Δδ	Remark
292.1931	CE Del	20 23 02.93	+10 19 14.8	1078.0911	A	−3.1	−0.4	
293.1931	CG Del	20 23 15.07	+17 29 26.1		A	−6.7	−2.3	
294.1931	WW Del	20 26 51.17	+15 36 58.5	1632.1262	A	+1.3	−0.9	
295.1931	XX Del	20 28 17.28	+18 33 17.2	1636.0287	A	+3.3	+0.3	
296.1931	AA Del	20 31 23.14	+18 00 40.2	1636.1159	A	+4.5	−0.5	
297.1931	AD Del	20 33 04.27	+13 28 23.8	1099.0086	A	+3.9	+3.1	
298.1931	AE Del	20 33 03.82	+17 33 11.1	1637.1761	A	+2.6	−1.1	
299.1931	SY Del	20 33 15.79	+14 58 53.8	1100.0264	A	0.0	+0.2	
300.1931	BL Del	20 34 03.03	+15 05 05.9		A	−0.7	−0.2	
301.1931	DG Del	20 35 44.13	+11 28 09.2		A	+0.8	+1.7	
302.1931	DF Del	20 35 49.21	+12 16 37.3	1096.1126	A	+4.7	+0.2	
303.1931	AL Del	20 36 15.84	+13 05 20.4	1096.0502	A	−1.0	−0.1	
304.1931	DK Del	20 37 35.67	+15 48 39.0	1633.0688	A	−2.6	+0.1	
305.1931	BO Del	20 39 23.64	+14 23 40.3		A	+5.9	+1.0	
306.1931	AP Del	20 40 13.33	+13 24 33.5	1100.1011	A	−0.4	+0.9	
307.1931	TU Del	20 40 50.66	+14 50 50.6	1100.0689	A	−1.7	+0.1	
308.1931	DS Del	20 43 28.73	+14 34 18.5	1101.1126	A	+5.0	+0.4	
309.1931	DT Del	20 43 57.05	+10 24 01.7	1093.2929	A	−4.6	+0.1	
310.1931	BQ Del	20 44 24.57	+14 28 25.4	1101.2152	A	+0.7	+0.5	
311.1931	DU Del	20 45 37.91	+11 36 45.6	1097.2088	A	+0.4	−0.2	
312.1931	AU Del	20 46 04.34	+13 16 43.8	1101.2275	A	+2.3	−0.3	
313.1931	AW Del	20 47 56.18	+17 04 20.7	1638.2621	A	+1.6	+0.2	
314.1931	EE Del	20 51 51.64	+12 37 30.9		A	−3.3	−0.8	
315.1931	AZ Del	20 52 16.28	+14 46 34.6		A	−7.7	+1.2	
316.1931	BS Del	20 52 58.26	+16 02 42.3	1647.1877	A	+0.4	+1.3	
189.1930	BV Del	20 53 09.95	+16 08 49.1	1647.1633	A	−0.8	−0.8	3
754.1933	V2067 Oph	16 59 28.09	−2 17 42.0	5055.0638	A	+3.7	−0.2	
755.1933	NSV 08128	17 01 54.50	−0 44 18.5	5064.0040	A	−2.1	−1.0	
756.1933	NSV 08133	17 02 26.07	+2 00 18.2	0402.2670	A	−0.4	−0.5	
757.1933	NSV 08188	17 06 03.80	+1 43 20.2	0398.1205	A	−6.0	+0.3	
758.1933	NSV 08223	17 07 54.23	−3 27 02.0	5069.1075	A	−2.5	+0.8	
759.1933	NSV 08236	17 09 11.08	−2 34 31.6	5069.0146	A	+7.4	+0.2	
760.1933	NSV 08235	17 09 03.80	+0 43 34.4	0399.1293	A	+3.8	+1.3	
761.1933	V2047 Oph	17 09 16.18	+0 42 41.8	0399.1432	A	−1.8	+1.5	
762.1933	V858 Oph	17 10 08.18	−2 35 55.0	5069.0083	A	−1.6	+0.8	1,4
763.1933	NSV 08256	17 10 22.00	−4 03 35.4	5073.1002	A	−0.4	+1.1	
764.1933	NSV 08351	17 13 53.98	−3 59 49.0	5073.1000	A	+1.6	−0.4	
765.1933	V2070 Oph	17 15 17.55	−0 16 03.4	5066.0028	A	+4.4	+0.3	
766.1933	NSV 08441	17 16 29.67	−0 29 16.3	5066.0736	A	+3.4	−2.0	
767.1933	V2072 Oph	17 16 59.81	−1 01 16.9	5066.1124	A	−11.1	−1.1	
768.1933	V1854 Oph	17 18 46.24	−2 03 43.0	5070.0468	A	+10.1	+0.4	
769.1933	V756 Oph	17 22 30.40	+1 46 48.1	0401.0572	A	+0.7	−0.1	
770.1933	NSV 08593	17 24 05.06	−1 03 28.6		A	+1.0	+0.2	
771.1933	V2054 Oph	17 24 46.77	−3 17 19.6	5071.0932	A	−2.8	+1.3	
772.1933	V767 Oph	17 30 44.88	+2 35 43.9	0418.0851	A	+0.1	+0.2	
773.1933	V2055 Oph	17 33 12.24	−2 14 36.4		A	+5.9	−1.6	
774.1933	NSV 09151	17 33 06.97	−4 09 20.2	5088.0340	A	−15.6	−1.3	2
775.1933	V671 Aql	19 45 57.28	+0 30 02.1		A	+8.9	+0.7	
776.1933	V539 Aql	19 47 52.61	−3 47 41.6	5154.1920	A	−2.2	+0.5	
777.1933	V686 Aql	19 48 44.43	−5 16 30.5	5154.1005	A	−4.0	+0.9	
778.1933	V541 Aql	19 48 27.62	+1 53 06.4	0484.2334	A	−0.3	+0.6	
779.1933	V542 Aql	19 48 46.79	−0 28 11.8		A	+2.4	+1.3	
780.1933	V423 Aql	19 48 40.77	+0 40 07.9	0480.3013	A	−1.4	−0.4	
781.1933	V689 Aql	19 49 20.09	−4 08 57.7	5154.1648	A	−8.1	+1.4	
782.1933	V545 Aql	19 49 36.83	−2 03 29.0	5150.1892	A	+0.8	−1.5	
783.1933	V548 Aql	19 49 59.50	−2 02 24.5		A	−3.5	0.0	
784.1933	V549 Aql	19 50 38.59	−3 57 25.0	5154.0268	A	−1.4	+0.9	
785.1933	V551 Aql	19 51 17.72	−2 42 11.0	5150.2641	A	−5.0	+0.1	
786.1933	V553 Aql	19 51 52.01	+2 48 18.5	0484.1036	A	0.0	+0.1	
787.1933	V706 Aql	19 52 57.81	−2 05 48.6	5151.0518	A	+3.8	−1.6	

Table 1 (continued)

Prov. desig.	Name	RA (2000)	Dec	GSC	s	$\Delta\alpha$	$\Delta\delta$	Remark
788.1933	V501 Aql	19 53 09.81	−5 26 26.9	5155.1774	A	−8.7	−1.3	
789.1933	V554 Aql	19 53 21.12	−4 36 59.6		A	−2.5	−0.8	
790.1933	V344 Aql	19 53 24.66	+2 10 54.3		A	−3.0	−0.9	
791.1933	V345 Aql	19 53 47.29	+2 59 29.0		A	−2.5	+0.6	
792.1933	V556 Aql	19 54 43.49	-3 18 43.5	5151.1374	A	−0.8	+0.3	
793.1933	V558 Aql	19 54 54.80	-3 50 04.4		A	−3.0	0.0	
61.1924	EG Aql	19 55 12.94	−3 48 21.1		A	+0.1	0.0	
794.1933	V559 Aql	19 55 30.03	+2 26 40.9	0485.2192	A	−2.4	−0.3	
795.1933	V562 Aql	19 56 02.29	−0 35 58.3		A	−0.2	0.0	
796.1933	NSV 12577	19 56 18.82	+0 02 00.0	0481.2310	A	−1.0	0.0	
247.1930	QW Aql	19 56 46.33	+0 00 51.2	0481.2346	A	−0.6	0.0	
246.1930	GZ Aql	19 56 17.22	−0 02 57.8	5147.1014	A	+0.3	0.0	
797.1933	V502 Aql	19 56 35.47	−2 37 14.1	5151.1558	A	−5.1	−0.3	
798.1933	V724 Aql	19 56 42.70	+1 05 03.3	0481.2119	A	−5.1	−1.0	
Ross 263	QX Aql	19 58 28.59	−2 27 28.5	5151.0971	A	+14.2	+0.1	
799.1933	V503 Aql	19 59 14.04	−1 22 01.4	5147.2492	A	+3.7	+0.8	
800.1933	V565 Aql	19 59 17.31	+1 00 28.5	0481.3335	A	+5.4	+0.3	
801.1933	V745 Aql	19 59 23.57	−1 57 50.7	5151.0329	A	−0.3	−0.1	
802.1933	V566 Aql	19 59 23.21	+0 06 10.4		A	+3.4	−1.1	
803.1933	V567 Aql	19 59 42.72	+3 18 40.0	0485.3118	A	+3.2	−0.6	
804.1933	V568 Aql	20 00 20.73	−1 52 42.7	5164.0270	A	−0.1	−0.1	
805.1933	V754 Aql	20 00 39.76	−5 16 45.3	5168.0797	A	−2.5	+1.9	
806.1933	V752 Aql	20 00 28.21	+0 21 09.3	0494.2343	A	+3.7	−0.1	
807.1933	V569 Aql	20 00 19.16	+1 53 42.7	0498.1005	A	−2.8	+0.4	
808.1933	V570 Aql	20 00 28.39	+0 45 15.0		A	−1.8	+1.9	
809.1933	V762 Aql	20 01 06.87	+0 15 03.3	0494.0472	A	+5.2	−0.3	
810.1933	V504 Aql	20 01 47.76	+2 07 48.1		A	+8.0	+1.4	
811.1933	V765 Aql	20 02 04.81	−3 02 31.0	5164.1493	A	−0.2	+0.1	
812.1933	V766 Aql	20 02 02.19	+2 21 26.4	0498.1415	A	−0.3	+1.0	5
813.1933	V505 Aql	20 02 37.12	+0 16 25.1	0494.0745	A	+5.5	0.0	
814.1933	NSV 12733	20 03 06.32	−2 11 34.5	5164.0426	A	−2.8	+1.0	
815.1933	V507 Aql	20 03 20.28	−1 29 32.0		A	+3.9	+1.0	
816.1933	NSV 12760	20 04 27.70	−0 45 26.0	5160.0947	A	0.0	+1.0	
817.1933	V773 Aql	20 04 36.57	−1 29 47.5		A	−3.9	+1.6	
818.1933	V574 Aql	20 05 39.86	+2 19 41.9	0498.2398	A	+0.3	−0.9	
819.1933	V575 Aql	20 05 40.00	+3 22 49.2	0498.0394	A	+0.5	+0.2	
820.1933	V576 Aql	20 05 52.77	−1 10 01.8	5160.0016	A	−5.3	−0.7	
821.1933	V509 Aql	20 06 16.89	+2 27 24.9	0498.2413	A	+2.5	−1.2	
822.1933	V782 Aql	20 07 14.40	+1 29 31.2	0494.1203	A	−2.0	−0.2	
823.1933	V510 Aql	20 07 37.43	−2 27 06.2		A	−1.9	+0.1	
824.1933	V787 Aql	20 08 20.78	+0 04 24.7	0495.1967	A	+1.0	−0.4	
825.1933	V788 Aql	20 08 48.43	−1 04 22.8	5161.2404	A	+2.5	−0.2	
826.1933	V511 Aql	20 09 27.90	+2 02 59.0	0499.2269	A	0.0	+1.1	
827.1933	V512 Aql	20 10 16.65	−3 33 07.9	5165.0728	A	+2.2	0.0	
828.1933	V513 Aql	20 10 06.39	+0 22 51.4	0495.1434	A	−0.1	+1.0	
829.1933	V514 Aql	20 11 02.87	−4 17 37.8	5169.0419	A	−1.3	−0.6	
830.1933	V790 Aql	20 11 27.37	−0 47 14.7		D	−0.3	−0.2	
831.1933	V515 Aql	20 12 14.64	−0 23 28.0	5161.0517	A	+0.4	+0.5	
832.1933	V516 Aql	20 12 36.55	+1 54 47.7	0499.0092	A	+2.5	−0.3	
833.1933	V517 Aql	20 13 46.17	+2 59 31.0	0499.2064	A	−3.8	+1.4	
834.1933	V519 Aql	20 14 39.91	−1 10 36.1		A	−0.1	0.0	
835.1933	V518 Aql	20 14 37.44	+0 08 52.8	0495.1720	A	−0.3	+0.7	
836.1933	V520 Aql	20 14 44.59	+0 24 27.4	0495.1429	A	−3.9	+0.3	
837.1933	V589 Aql	20 15 55.18	+1 00 30.0	0496.0788	A	+1.3	+0.2	
838.1933	V521 Aql	20 17 01.98	−3 15 38.1	5166.1783	A	+2.9	+2.0	
839.1933	V523 Aql	20 17 42.64	−1 06 16.4	5162.1018	A	+2.7	+0.4	
840.1933	V522 Aql	20 17 33.07	−0 25 00.6	5162.1956	A	−5.3	+1.6	
841.1933	V524 Aql	20 17 58.57	+1 03 16.9	0496.1540	A	+4.7	−0.1	
842.1933	V525 Aql	20 19 50.22	−4 17 41.2	5170.1355	A	−1.8	+1.8	
Ross 276	V335 Aql	20 21 17.77	+1 19 19.0	0496.1648	A	−0.9	0.0	

Table 1 (continued)

Prov. desig.	Name	RA (2000)	Dec	GSC	s	Δα	Δδ	Remark
843.1933	V595 Aql	20 21 35.58	+0 43 09.9	0496.1261	A	−0.6	+0.6	
844.1933	V596 Aql	20 21 50.83	−1 52 47.5	5166.1391	A	+3.1	+1.6	
845.1933	UX Sge	20 18 07.11	+18 08 17.4		A	+0.3	−0.1	6
846.1933	BZ Del	20 22 18.78	+12 36 04.3	1082.0316	A	+5.1	+0.4	
847.1933	CF Del	20 23 31.33	+12 59 29.8		A	+7.0	−1.2	
848.1933	BE Del	20 23 50.56	+13 14 58.5	1086.1212	A	+2.4	+1.2	
849.1933	VY Del	20 23 51.96	+18 15 50.7	1635.1345	A	+8.0	−0.9	
850.1933	CN Del	20 25 20.19	+13 26 10.2		A	+2.2	−0.7	
851.1933	CP Del	20 25 54.39	+14 47 09.0		A	−3.3	−0.7	
852.1933	WY Del	20 27 20.52	+13 54 33.7		A	+3.9	−0.4	
853.1933	CR Del	20 28 50.14	+15 37 01.0	1632.1154	A	+0.2	0.0	
854.1933	CV Del	20 30 54.18	+16 32 34.3	1632.2095	A	−6.0	−0.6	
855.1933	AH Del	20 34 31.76	+14 02 37.2	1100.0326	A	+1.9	+3.3	
856.1933	AM Del	20 36 27.53	+13 30 34.8		A	+3.1	+1.1	
857.1933	AO Del	20 39 48.66	+17 20 57.4	1637.1138	A	+0.8	−1.7	
858.1933	DN Del	20 40 04.08	+13 48 25.4		A	−2.2	+1.7	
859.1933	DO Del	20 40 19.38	+13 52 45.4	1100.0374	A	−4.8	+0.1	
860.1933	AQ Del	20 41 02.68	+17 20 03.6	1638.0757	A	+2.8	−0.7	
861.1933	AS Del	20 42 13.63	+15 26 45.5	1634.0186	A	−2.2	−3.0	1
862.1933	DV Del	20 46 17.06	+13 05 41.4	1097.0641	A	+2.8	+0.7	
863.1933	DW Del	20 46 20.78	+15 48 24.7		A	−0.9	+0.4	
864.1933	EF Del	20 52 04.47	+12 51 23.7	1098.1375	A	+0.8	+0.1	
865.1933	BT Del	20 53 44.16	+15 44 07.1	1647.0208	A	+4.0	+0.7	
866.1933	EH Del	20 55 02.04	+13 48 04.4		A	0.0	+1.6	
867.1933	BR Cep	22 27 17.17	+66 10 00.5	4276.0502	A	−4.1	−0.2	
868.1933	BT Cep	22 31 30.35	+67 23 46.7	4276.0073	A	+0.1	0.0	
869.1933	CH Cep	23 10 43.59	+64 28 52.9	4287.0974	A	−2.0	−0.1	
870.1933	CK Cep	23 12 43.79	+63 57 17.0	4287.0722	A	+3.4	+0.3	
871.1933	NSV 14486	23 17 51.66	+62 08 06.1	4283.0021	A	+1.4	0.0	1

Remarks:

1. Two entries for the same star in A1.0. The position given in the table is an average.
2. Slightly uncertain identification.
3. BV Del – unlabeled circle on chart for BS Del.
4. V858 Oph – Two GSC numbers (5069.0083 and 5069.1384) for one star. Northern component of a double star, the southern one having position $17^{h}10^{m}8^{s}.05$, $-02°36'03''.0$.
5. V766 Aql – north on the bottom.
6. UX Sge – mean position of a close double, not known which component varies.

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NEAR IR TiO BAND PHOTOMETRY OF α Ori, 1996-1997

α Orionis (Betelgeuse, HD 39801, M2Iab) is the brightest star in the infrared sky. It is also one of the closest, with the recent *Hipparcos* Survey revising its distance determination to 131 ± 30 pc (Wing 1997). The star's relative proximity, coupled with its semi-regular variability and advanced evolutionary age, has made it an attractive target for a number of studies. For example, Guinan *et al.* (1993) have reported an overall photometric variability of 0.45 mag over the last decade, while Dupree *et al.* (1987) have found a 1.15 yr periodic modulation of 0.26 mag in blue wavelengths that stretches back to 1984. Gilliland and Dupree (1996) have used direct imaging techniques with HST to uncover a substantially extended chromosphere in the supergiant as well as a large bright spot that appears hotter than the surrounding chromosphere by at least 200 K. Dyck *et al.* (1992) have even used 2.2 μm interferometric techniques to obtain an angular diameter for α Ori of 44.2 mas. This corresponds to a radius of 620 $R_\odot$.

Despite these studies, α Ori remains an enigmatic object. There is still some question as to the proper mass loss mechanism that can form the star's extensive circumstellar envelope (Dupree *et al.* 1987). Furthermore, the period of pulsations may not be constant with time. There is also evidence of period-doubling and period-tripling in the star's visible flux (Smith 1990) that hints at the star's internal complexities. Optical wavelength observations of α Ori have continued up to the present by Krisciunas & Luedeke (1996) and at Villanova University by Guinan (1997) since 1981, but have shed little light on these stellar riddles. To understand and better quantify the behavior of α Ori, we decided to undertake a more extensive program of differential photometry of this famous star.

From September 1996 to April 1997, α Ori was observed at the Wasatonic Observatory (Allentown, Penn.) as part of the ongoing program between the Wasatonic and Villanova Observatories to study cool giants and supergiants. The photometry reported here was conducted on a total of 23 nights using an uncooled Optec photometer attached to a 20-cm Schmidt-Cassegrain telescope. The detector employed was a silicon PIN-photodiode. The comparison star was Φ^2 Ori (V = +4.09, B−V = +0.95, K0III) and the check star was γ Ori (V = +1.64, B−V = −0.22, B2III). Differential photometry was conducted using the standard sequence of sky-comp.-var.-comp.-sky-check-comp.-sky in both the V-band and Wing near-IR three filter system to measure TiO (Wing 1992).

Wing's photometric system is characterized by observations in three separate band-passes denoted by A, B, and C. Table 1 lists the central wavelengths and bandwidths of these three filters. These filters were chosen to measure the three basic properties of cool stars: their infrared magnitude, their color, and their temperature (as measured by the strength of their TiO absorption band). Filter A is sensitive to the TiO $\gamma(0,0)$ 719 nm bandhead, while filters B and C are essentially clear of strong absorptions. In order to extract an unreddened measure of the strength of the TiO band, Wing (1992) has devised a reddening-free TiO index as: $A - B - 0.13(B - C)$

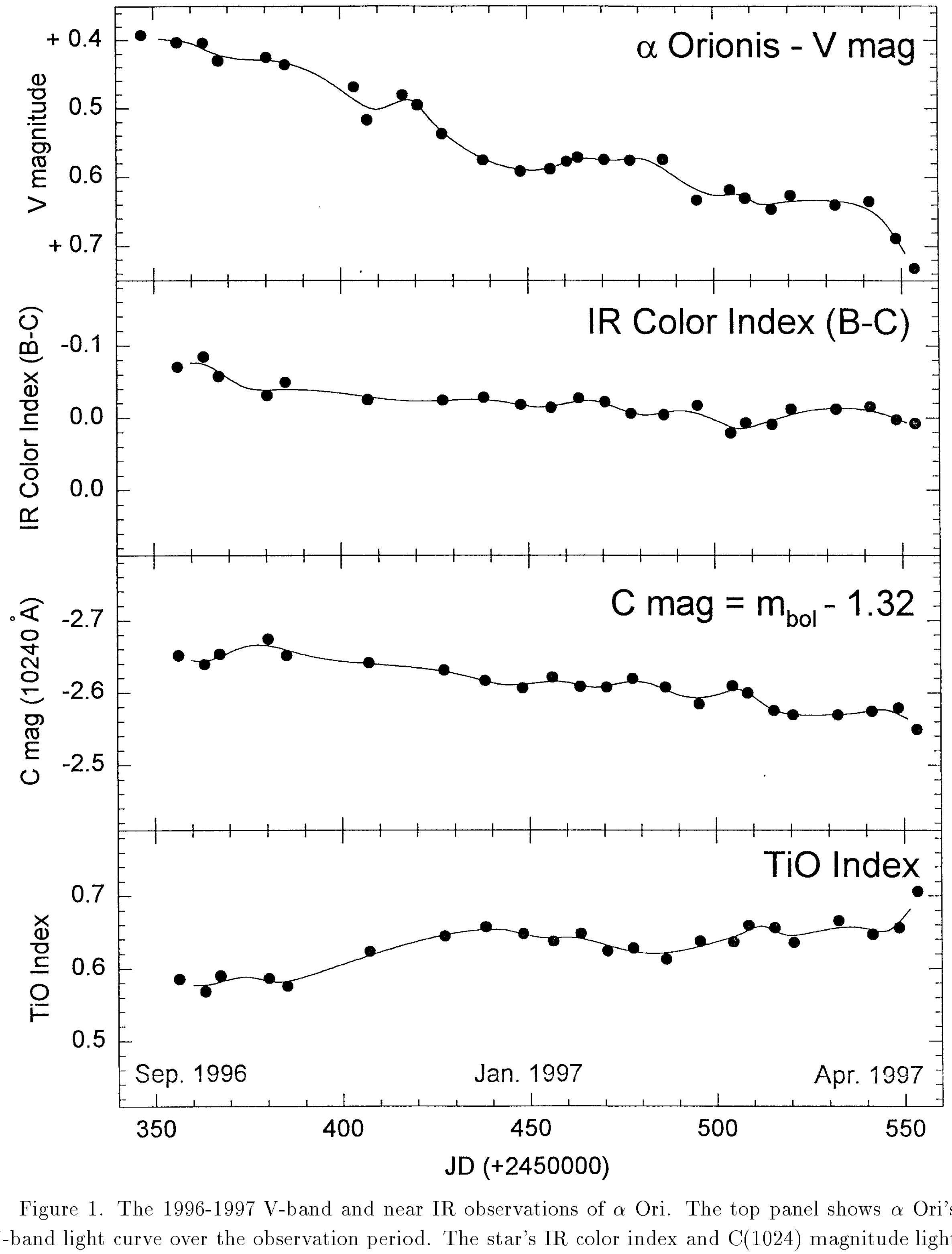

Figure 1. The 1996-1997 V-band and near IR observations of α Ori. The top panel shows α Ori's V-band light curve over the observation period. The star's IR color index and C(1024) magnitude light curves are shown in panels 2 and 3, respectively. The bottom panel is a plot of TiO indices as defined by Wing's three color filter system. Note the inverse correlation between TiO strength and brightness of the star

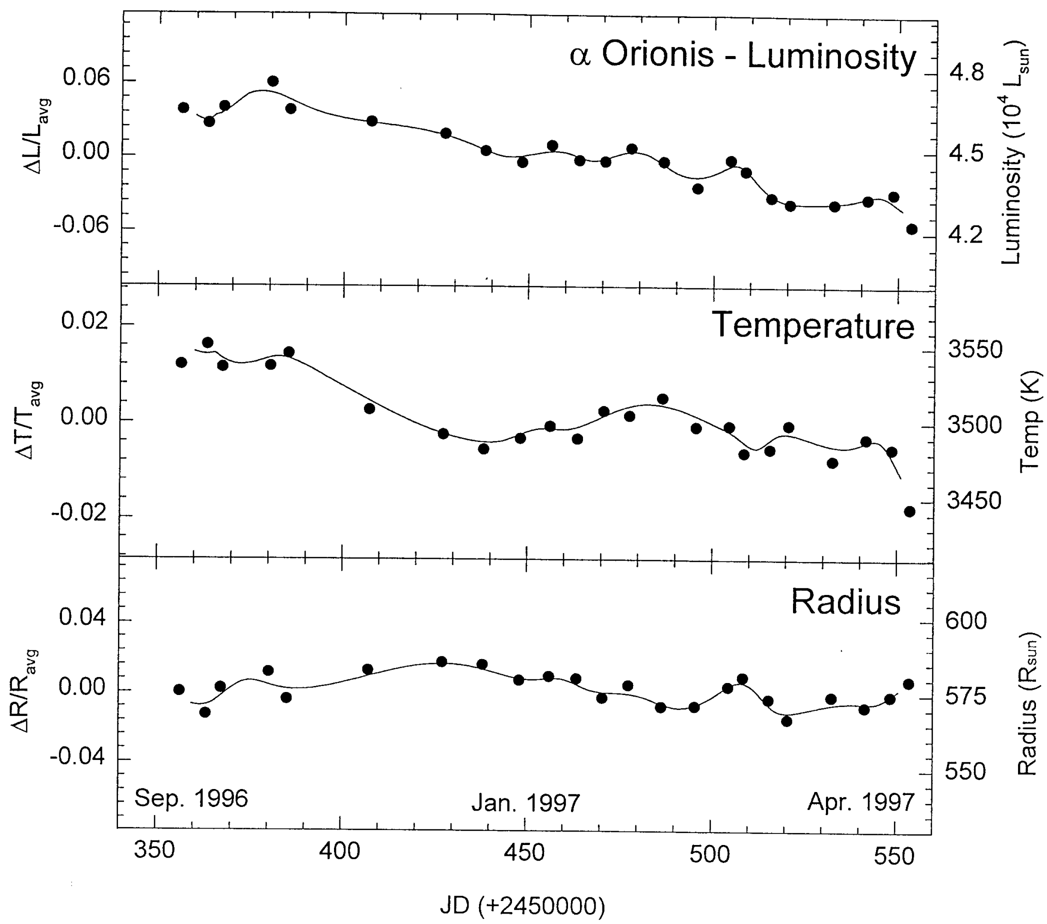

Figure 2. Results for α Ori for the 1996-1997 observation period. The top panel shows the star's luminosity. The middle panel shows α Ori's temperature as derived from TiO indices. The bottom panel depicts α Ori's radius over time based on a symmetric, global pulsation model

Table 1. Wing's Three Color Near IR Filter Set[1]

Filter	Region Measured	Central Wavelength (nm)	Bandpass(FWHM) (nm)
A	TiO Band	719	11
B	Continuum	754	11
C	Continuum	1024	42

[1]Taken from Wing (1992)

where A, B, and C are the magnitudes in those respective filters. The quantity (B$-$C) is defined as the star's near IR color index. Wasatonic (1997) has provided a calibration system based on standard stars (Wing 1978) that relates TiO strength to a star's temperature. The result is an inverse correlation between temperature and TiO index for K5 to M7 stars shown below:

$$Temp(K) = 3990 - 775(\text{TiO-Index})$$

Table 2. Wasatonic Observatory Filter A,B,C Data for α Ori: Sep 1996–Apr 1997

JD (2450000+)	A	B	C	JD (2450000+)	A	B	C
356.328	−2.145	−2.721	−2.651	477.622	−1.998	−2.625	−2.619
363.303	−2.166	−2.723	−2.639	486.506	−1.999	−2.611	−2.607
367.382	−2.128	−2.710	−2.653	495.540	−1.966	−2.601	−2.584
380.312	−2.123	−2.705	−2.674	504.507	−1.949	−2.588	−2.609
385.218	−2.131	−2.700	−2.651	508.526	−1.932	−2.592	−2.599
407.194	−2.046	−2.666	−2.641	515.522	−1.909	−2.566	−2.575
427.197	−2.014	−2.655	−2.631	520.616	−1.947	−2.581	−2.569
438.127	−1.991	−2.644	−2.616	532.555	−1.917	−2.581	−2.569
448.084	−1.979	−2.624	−2.606	541.555	−1.944	−2.589	−2.574
456.146	−2.000	−2.635	−2.621	548.555	−1.920	−2.576	−2.579
463.533	−1.991	−2.635	−2.608	553.555	−1.834	−2.541	−2.549
470.592	−2.008	−2.629	−2.607				

It should be noted that this relationship fails outside the specified spectral classes since TiO band strengths are insensitive to temperature changes outside of the K5 to M7 range.

The bolometric magnitude (m_{bol}) of the star can also be approximated using the Wing system. Filter C is an accurate measure of an M star's near-infrared continuum and covers their wavelengths of peak intensity. Furthermore, it is known that near-infrared continuum points of Mira variables are very similar to their bolometric light curves in terms of shape, phase and amplitude (Lockwood & Wing, 1971; Wing 1986). Hence the magnitude of filter C is a good representation of the star's apparent bolometric magnitude. Using bolometric corrections from Novotny (1973), we compared the apparent m_{bol} and C(1024) magnitudes of stars with comparable temperatures to α Orionis. A total of eight M2III Wing standard stars (Wing 1978) were used in the comparison. Since bolometric corrections are nearly identical for M2 giants and supergiants (Novotny 1973), we found that for both classes of stars:

$$m_{bol} = C + 1.32$$

where C represents the magnitude of the C(1024) filter. This magnitude correction has a standard deviation of $\sigma = 0.075$. The luminosity of the star can then be calculated from its m_{bol} by the usual means.

The data collected at the Wasatonic Observatory is listed in Table 2. Observations were conducted in both V-band and Wing's three color filter system with light curves shown in Figure 1. The first panel shows a plot of α Ori's V-band light curve. α Ori dropped 0.3 mag in V-band brightness over the observation period. The maximum brightness of +0.4 mag is about the brightest the star ever achieves (Guinan 1997). Light curves of the star's near IR color index and C(1024) magnitude are shown in the second and third panels, respectively. The small-scale fluctuations in the data appear to be physical variations and are not observational scatter. TiO indices were then calculated using the Wing system described above and are shown in the bottom panel of Figure 1. Note the general anti-correlation between TiO band strengths and the brightness of the star.

Figure 2 summarizes our results based on the near IR data. The top panel shows α Ori's luminosity, the middle panel its effective temperature, and bottom panel its effective radius over our observation period. The left axis of the figure shows relative changes with respect to the mean, while the right axis shows absolute values. As shown in the top panel, α Ori's luminosity systematically dropped approximately 12% with respect to the mean over our observation stretch. This was accompanied by a 4% systematic drop in effective temperature during the same time interval. Based on our TiO data, α Ori showed an average effective surface temperature of 3500 K. The maximum and minimum temperatures were 3550 K and 3440 K, corresponding to TiO indices of 0.568 and 0.706, respectively. These temperature values agree well with the interferometric estimated surface temperature of 3520 ± 85 K by Dyck *et al.* (1992).

It is still uncertain whether the luminosity changes shown in the top panel of Figure 2 are due to uniform, global pulsations of the star, or the growth and decay of local hot-spots on the surface. Goldberg (1984) concludes from radial velocity data that the visual brightness variations are probably not global in nature. However, Dupree *et al.* (1987) assert that the regularity of α Ori's variability argues against the erratic (random) variability associated with the emergence of convective cells. Under the assumption that the luminosity variations are global in nature, the effective radius of α Ori was computed for each observation. The result is shown in the bottom panel of Figure 2.

α Ori exhibited an average effective radius of 575 $R_{\odot}$ with changes of less than 2% above and below the mean radius over the observation period. This value compares with past interferometric radius determinations. For instance, Dyck *et al.* (1996) used 2.2 μm observations to obtain an angular diameter of 44.2 mas, corresponding to a radius of 620 $R_{\odot}$, and Balega *et al.* (1982) have used 7730 Å observations to obtain an angular diameter of 62 mas, corresponding to a radius of 870 $R_{\odot}$. This paper's result, however, represents the first findings of α Ori's radius using intermediate infrared observations and the new *Hipparcos* distance.

Curiously, there appears to be no systematic change in α Ori's effective radius to match the trends discussed above for α Ori's luminosity and temperature. This might indicate that global pulsations are not alone responsible for α Ori's brightness variations. Instead, the growth and decay of local blobs and hot-spots may contribute to α Ori's variability in a non-trivial way. More near IR and radial velocity data is needed before any permanent conclusion can be reached. It should also be noted that our absolute luminosity and radius values critically depend on the empirically derived transformation between the C(1024) filter and bolometric magnitude. Further observations of M2I and III stars using Wing's near IR filter system would improve the reliability of this transformation. Observations of α Ori at the Villanova and Wasatonic Observatories will continue in both V-band and near IR wavelengths.

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RADIUS AND LUMINOSITY VARIATIONS OF MIRA FROM WING NEAR-IR PHOTOMETRY

Mira (omicron Ceti AB) is the prototype of a class of pulsating red asymptotic giants that undergo large (typically 3 to 7 mag. in V) brightness variations with periods of a few hundred days. Mira itself is more complex as it is a binary system composed of the luminous M4-7IIIe star (o Ceti; Mira A; HD 14386) and a hot accreting component $0''.6$ distant (Mira B). *AAVSO* visual estimates of Mira A have shown its brightness to vary typically between 3rd and 10th magnitude over a period $P \sim 332$d. Recently Mira's parallax has been re-determined by *Hipparcos* to be $r = 129 \pm 18$pc (van Leeuwen *et al.* 1997). As one of the nearest Mira variables, its brightness has made it a favorite object for spectroscopic, photometric and interferometric measurements.

Of particular interest to the study of Mira, and Mira variables in general, are observations obtained in the infrared. Among the coolest of all stars, their maximum energies lie in the near-infrared, and typical Miras are 6-10 magnitudes brighter in this region than they are in the optical. Also, there are fewer molecular absorption features in the infrared than at optical wavelengths. As discussed by Wing (1992), the interpretation of standard *UBVRI* optical photometry of Miras and other cool variables is compromised chiefly by the presence of strong TiO molecular features that fall within these bandpasses for stars with spectral types of M0 or later. For these reasons, Wing (1992) has developed a simple near-infrared photometric system for use with red stars, including Miras. This photometric system uses three intermediate-band filters that have been carefully chosen to have bandpasses that include a temperature dependent TiO molecular band and two in the near IR that are essentially free of strong absorption features, except in the coolest of stars.

The first filter, designated by Wing as A, is centered around one of the strongest isolated TiO (γ;0,0) bands and has a central wavelength of 719 nm. TiO was chosen because it is an excellent temperature indicator in cool stars and it has been known for a long time that visual maximum corresponds to the time of highest temperature and weakest TiO band strength in Miras (Pettit & Nicholson 1933). Filter B, with a central wavelength of 754 nm, is placed in a region essentially clear of strong absorptions except in the coolest of stars. Both A and B have bandpasses of 11 nm. Filter C is also located at a region essentially free of absorption, but at a much longer wavelength, centered at 1024nm, where it provides a measurement of the infrared apparent magnitude. Its bandpass is larger at 42 nm which compensates for the usual decreased detector sensitivity at this wavelength.

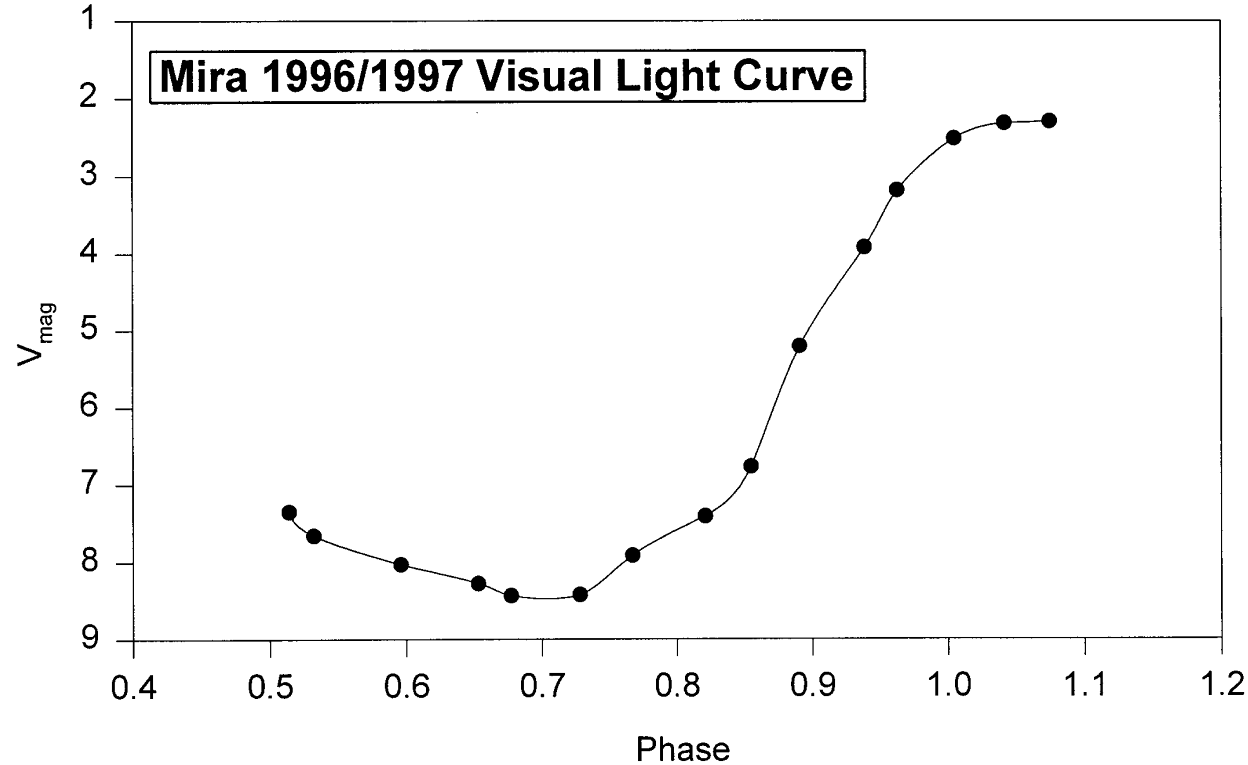

Figure 1. V light curve of Mira covering half of its pulsation period

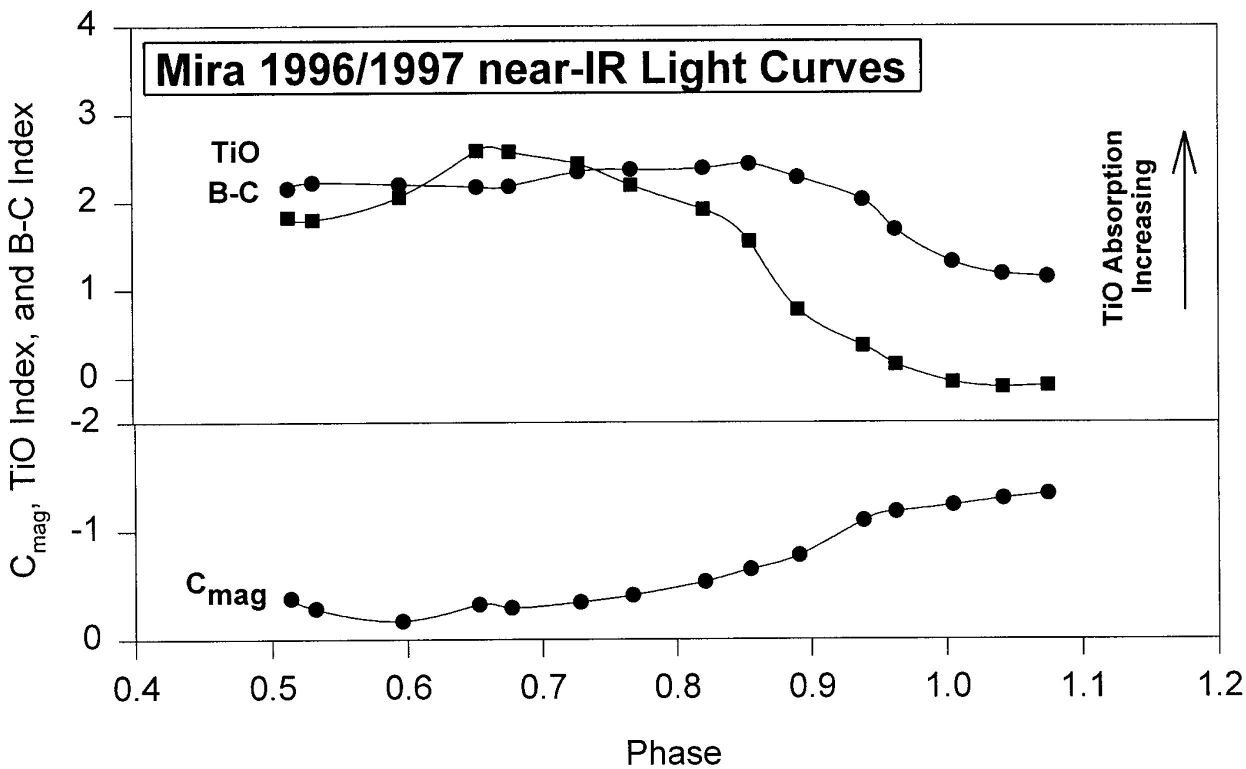

Figure 2. Light curves of Mira's TiO Index, B−C Index, and $C(1024)_{mag}$

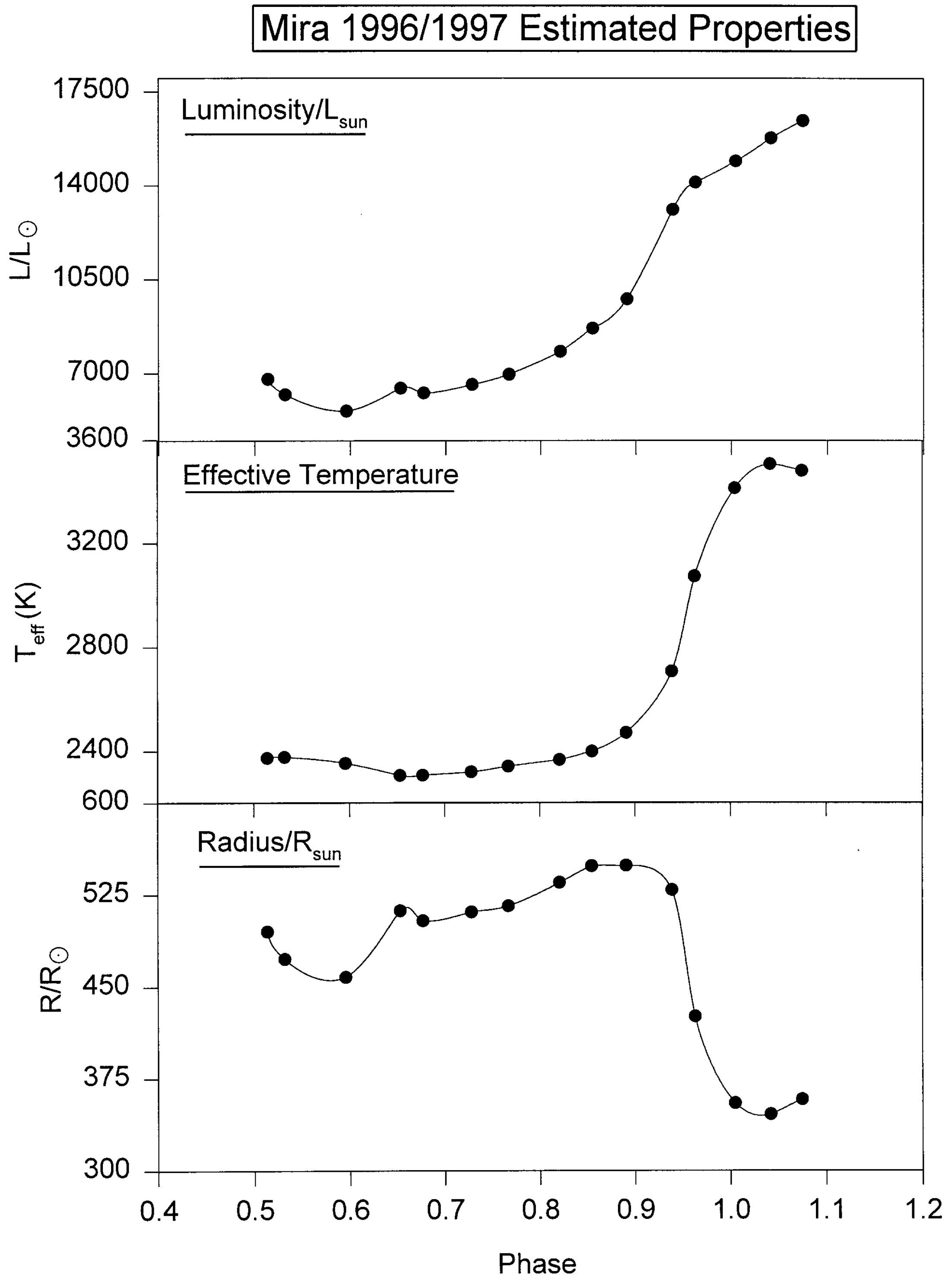

Figure 3. Luminosity, effective temperature and radius of Mira. The properties were estimated using the near-IR B−C Color Index to obtain an effective temperature, and the transformed $C(1024)_{mag}$ as an approximation of m_{bol}

As discussed by Wing (1992), filter C can also be used as a short-cut to measuring the star's total energy output as the light curves of Mira variables, measured at near infrared continuum points, are similar to bolometric light curves in shape, amplitude, and phasing (Lockwood & Wing 1971; Wing 1986). Filters B and C are used together to obtain a color index defined by:

$$\text{near-IR Color Index} = B - C$$

Because this color index measures the slope of the continuum and is affected little by spectral lines and bands, it is primarily an indicator of temperature. Finally a TiO index can be obtained by using the magnitudes of all three filters in the formula:

$$\text{TiO Index} = A - B - 0.13 \times (B - C)$$

With this method, the continuum level is extrapolated to the TiO wavelength band and the observed magnitude at this band is compared to the magnitude the star would have if no TiO band were present. The numerical coefficient is determined by the spacing of the filters in wavelength. The TiO Index is the measure of the relative strength of the TiO bandhead near 719nm and, as defined, the index becomes numerically larger as the TiO absorption increases.

Starting in 1996, photometric observations of Mira covering half of its pulsation period (from light maximum to past light minimum) have been carried out by Wasatonic using the Wing near-infrared ABC bands just described, as well the V-band. With a 20-cm Schmidt-Cassegrain (SCT) coupled to an uncooled Optec photometer, the photometry was carried out relative to nearby and check stars, following the usual observing sequence of sky-comp.-var.-comp.-sky-check-comp.-sky. The comparison star was HD 16400 (V = +5.65, B−V = +1.02, G5 III) and HD 16160 (V = +5.82, B−V = +1.04, K3 V) was the primary check star. In addition, several Wing standard stars ranging from M1 to M7 were observed most nights and their TiO and B−C indices were obtained. The photometric observations of Mira are provided in Table 1.

Table 1. Photometric data

JD2450000+	V	A	B	C
314.0	7.351	3.842	1.452	−0.377
320.0	7.656	3.971	1.515	−0.282
341.0	8.030	4.360	1.891	−0.169
360.0	8.277	4.773	2.262	−0.322
368.0	8.434	4.800	2.284	−0.290
385.0	8.425	4.757	2.095	−0.343
398.0	7.916	4.445	1.790	−0.405
416.0	7.410	4.023	1.387	−0.530
427.0	6.767	3.550	0.911	−0.644
439.0	5.210	2.384	0.002	−0.772
455.0	3.922	1.355	−0.723	−1.090
463.0	3.187	0.689	−1.020	−1.172
477.0	2.516	0.034	−1.280	−1.232
489.0	2.320	−0.226	−1.396	−1.293
500.0	2.297	−0.287	−1.425	−1.337

Figure 1 shows the visual-band light curve. Phasing was done using a t_{max} of JD 2447823 and a period of 331.9 days (Quirrenbach *et al.* 1992).

Using the formula previously described, the TiO index was calculated for each observation. Figure 2 shows the TiO Index, B−C Index, and the C_{mag} light curve versus phase. From the data, it can be seen that the bolometric magnitude, which is computed from C_{mag} (see below), reaches its faintest value near Mira's minimum phase at 0.6 - 0.7P. As would be expected, the B−C color index also reaches its greatest value at this phase indicating the lowest temperature. The TiO index becomes unreliable as a temperature indicator at Mira's minimum because the continuum regions of the spectrum become contaminated by lines of VO and other molecular species at $T_{eff} < 2400$K (Wing 1992). This is noted in Figure 2 as the TiO index is nearly constant from phases 0.5 - 0.9P.

To test the accuracy of using the $C(1024)_{mag}$ as an approximation of the apparent bolometric magnitude m_{bol}, a calibration was carried out using a large number of Wing standard stars whose $C(1024)_{mag}$ or comparable $I(1040)_{mag}$ are given by Wing (1978), and whose V magnitudes and spectral type are known (Wing 1978). By calculating m_{bol} for each of these stars by the standard formula:

$$m_{bol} = V_{mag} + BC$$

and comparing the results to the given $C(1024)_{mag}$, it was found that the $C(1024)_{mag}$ was fainter by an average difference of ~ 1.04 mag with a standard deviation of ± 0.31 mag. Therefore, this difference was added to each C filter reading to obtain a good estimate of the apparent bolometric magnitude. The bolometric correction (BC) values were obtained from Novotny (1973).

Using this adjusted value of m_{bol}, and the distance to Mira, the absolute bolometric magnitudes (M_{bol}) were calculated for each observation phase. Mira s luminosity was then calculated relative to the sun s and is shown in the upper panel of Figure 3.

An estimate of Mira's temperature at each observation phase was determined by applying a set of standard stars whose effective temperatures are known, and whose B−C color indices were obtained by Wasatonic. The middle panel of Figure 3 shows the variations of Mira's temperature with phase.

With estimates of both Mira's luminosity and temperature at each observation phase, a radius can be determined from the standard formula:

$$L = 4\pi\sigma R^2 T^4$$

The bottom panel of Figure 3 shows Mira's radius versus phase. Large scale radius changes from an $R_{min} = 345R_{\odot}(1.6$ AU), to an $R_{max} = 548R_{\odot}(2.5$ AU) can be seen in the plot. To place Mira s size in better perspective, if the star were placed at the center of our solar system, it would extend from just beyond the orbit of Mars (1.5 AU) to half way the distance of Jupiter (5.2 AU). The following table summarizes the extremes of the properties of Mira found during the 1996/97 epoch.

Table 2. Mira's Estimated Properties

V_{mag}	B-C Index	T_{eff}	Spec. Type	$L/L_{\odot}$	$R/R_{\odot}$	Radius (AU)
+2.29	−0.103	3520	~M0 III	1.6×10^4	345	1.6
+8.43	+2.584	2350	~M9 III	5.6×10^3	548	2.5

This work represents the first time the radius of Mira has been estimated using its proper distance and intermediate-band near-infrared photometric techniques. The values obtained for the radius compare well with previous interferometric measurements, such as those of Labeyrie *et al.* (1977) who found a radius of $\sim 645 R_{\odot}$ at 1040nm at light maximum (Phase $\sim$ 0.0). Also, the mean radius of $464 R_{\odot}$ recently reported by van Leeuwen *et al.* (1997) is in excellent agreement with our mean radius of $474 R_{\odot}$. However, interferometric observations at 775nm by Karovska *et al.* (1991), when corrected for Mira's recently determined distance, yield an average radius of $\sim 1100 R_{\odot}$ at nearly light maximum (Phase $\sim$ 0.97). Again, it should be noted that our estimates of radius and luminosity are based upon a transformation of the $C(1024)_{mag}$ to m_{bol}. Relative changes obtained for the radius of Mira, however, are not dependent on this approximation and should be of particular interest. Further near-IR observations of Mira over its entire pulsation period and the results of radius estimates will be reported in the future.

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